INSTRUCTION MANUAL

FTV-901R

YAESU MUSEN CO , LTD.

TOKYO JAPAN.

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FTV-901R
VHF/UHF TRANSVERTER



GENERAL

The FTV-901R is an all-new transverter for the FT-901DM and FT-101ZD series, capable of operation on the 50, 144, and 430 MHz bands. The basic unit comes equipped with 144 MHz capability, and the 50 and 430 MHz band modules may be added as options. Power input is 20 watts on all three bands.

For satellite operators, three satellite bands are provided, allowing full duplex operation through the transverter, using an external receiver in addition to the FT-901DM. The operator can transmit on 145 MHz while listening on 29 MHz or 435 MHz, or transmit on 435 MHz while listening on 145 MHz.

The FTV-901R also includes repeater split for 50 and 144 MHz, allowing full use of the FM capability of the FT-901DM. Fully solid state, the FTV-901R includes protection for the final amplifier transistors against damage caused by high SWR. Spurious radiation is at least 60 dB down.

The owner is urged to read this manual in its entirety, so as to become better acquainted with the exciting new FTV-901R. With proper care in operation, this equipment should provide many years of trouble-free operation.

SPECIFICATIONS

Frequency range:
50–54 MHz (option)
144–148 MHz
430–440 MHz (option)

Mode:
SSB, CW, AM, FM

Input impedance:
50–75 ohms

IF output frequency:
28–30 MHz

RF power output:
10 watts @ 50% duty cycle

Drive requirements:
3 V RMS at 28–30 MHz

Receiver spurious responses:
Image rejection better than 50 dB.
Internal spurious signals below 1 μV equivalent to antenna input.

Size:
210(W) x 157(H) x 352(D) mm

Weight:
10 kg

SEMICONDUCTOR COMPLEMENT

FET:

3SK51-03	6	3SK59Y	1

Silicon Transistors:

2SC730	2	2SC2053	2
2SC784R	6	2SC2166	1
2SC1424	5	2SC2369	2
2SC1426	2	2SC235D	1
2SC1815Y	11	MJE3055	1
2SC1945D	1		

Integrated Circuits:

MC1496G	2	μPC14308	1
78L08	3	TA7089M	1

Germanium Diodes:

1S188FM	6

Silicon Diodes:

1S1555	46	10D1	13
MC301	2	S4VB	1
1SS53	22		

Schottky Barrier Diodes:

1SS43	4

Zener Diode:

WZ110	1

Varactor Diodes:

1S2209	12

Power Modules:

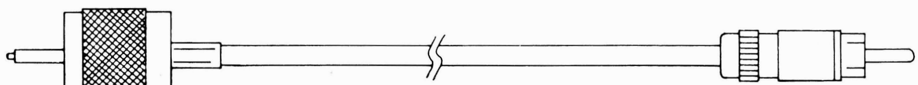
VP20BL	1	VP07BL	1

Light Emitting Diodes:

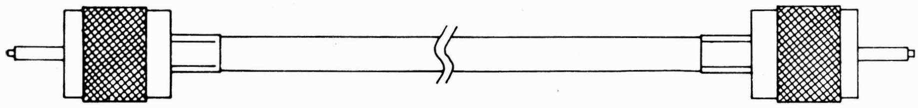
GD4-203SRD	9

ACCESSORIES:

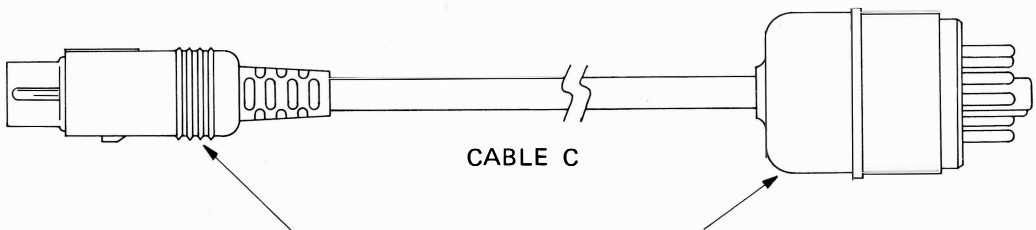
Cable A	1 pc.	RCA plug	1 pc.
Cable B	1 pc.	Spare fuse	1 pc.
Cable C	1 pc.		



CABLE A



CABLE B

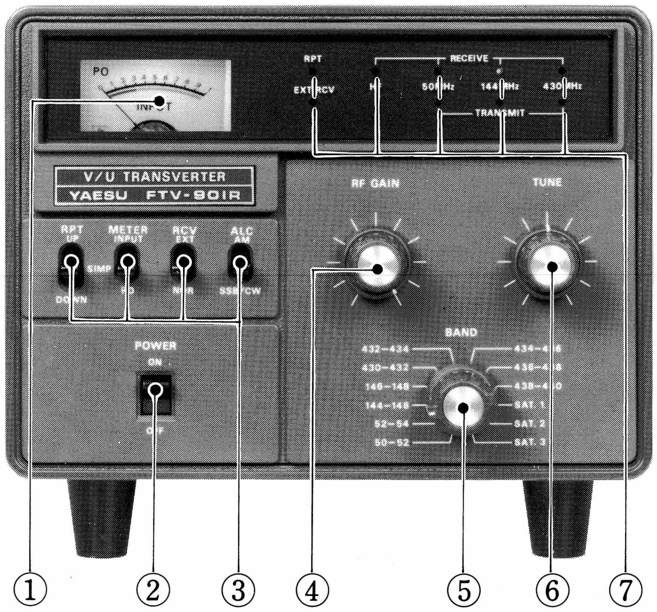


CABLE C

PIN · No.		COLOR	PIN No.
1	HEATER1	WHITE	1
2	HEATER2	BLUE	2
3	No. C		
4	HEATER1'		1
5	HEATER2'		2
6	TX; GND	RED	9
7	RX; GND	GREEN	10
GROUND SHELL	EARTH	BLACK	8

Cable C Connections

FRONT PANEL CONTROLS AND SWITCHES



(1) METER

Depending on the position of the METER switch, the meter displays the drive level or the relative output level of the transmitter.

(2) POWER

This is the main ON/OFF switch for the transverter.

(3) FUNCTION SWITCHES

SHIFT (UP/SIMP/DOWN)

For 144 MHz, this switch selects ±600 kHz repeater shift, or simplex operation. When the optional 50 MHz unit is installed, this switch selects ±1 MHz split, or simplex operation.

METER

When set to the input position, the METER selects indication of the input level for meter display. In the PO position, relative power output is displayed.

RCV

In the NOR position, both transmit and receive functions are accomplished by the FT-901DM or other transceiver. When set to the EXT position, reception is accomplished on an external receiver. This is normally used only for satellite operation.

ALC

This switch selects the ALC threshold level. For FM operation, use the SSB/CW position.

(4) RF GAIN

This control sets the receiver RF gain level for 50 and 144 MHz operation. This control is not used for 430 MHz.

(5) BAND

For 50 and 144 MHz, two bandswitch positions are used. For 430 MHz, 5 bandswitch positions are assigned. Each bandswitch position tracks 500 kHz, the tuning range of the FT-901DM.

The SAT. 1 position is for OSCAR Mode A: 144 MHz transmit, 28 MHz receive. The SAT. 2 position is for OSCAR Mode B: 430 MHz transmit, 144 MHz receive. The SAT. 3 position is for OSCAR Mode J: 144 MHz transmit, 430 MHz receive.

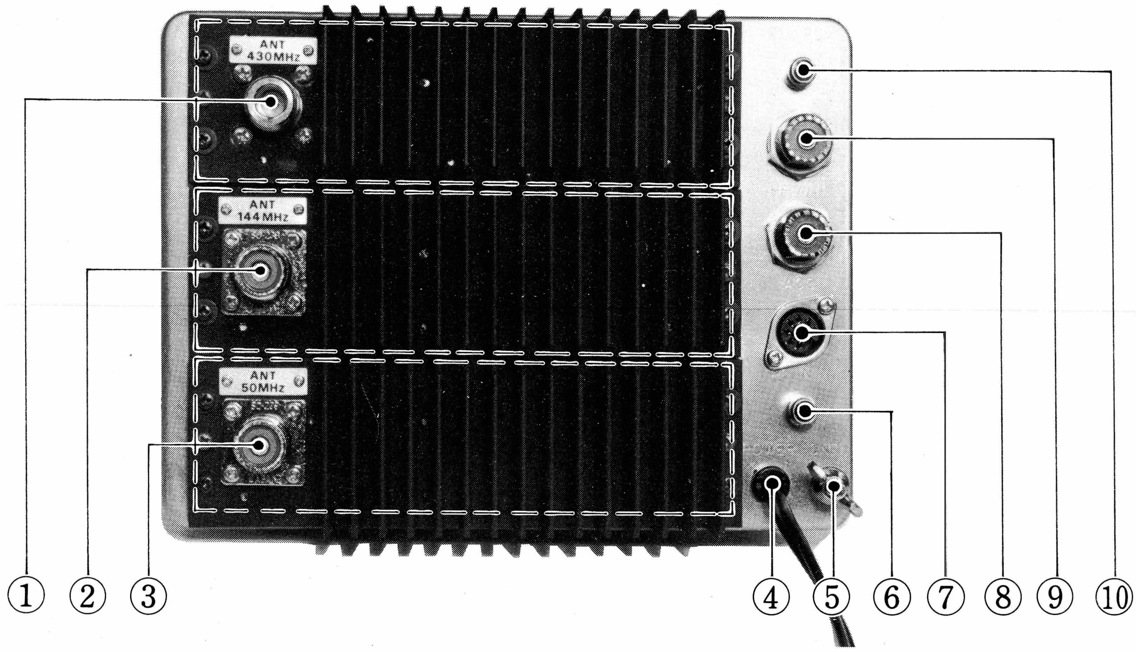
(6) TUNE

This control peaks the transmitter section of the transverter, on the 50 and 144 MHz bands. This control is not used for 430 MHz.

(7) INDICATOR LEDs

These light emitting diodes indicate which band is being used for transmit and receive, and also indicate repeater and external receiver operation.

REAR PANEL



(1) 430 MHz UNIT and ANTENNA JACK

When the optional 430 MHz unit is installed, the 430 MHz antenna should be connected here. An N-type connector is utilized, for improved UHF performance.

(2) 144 MHz UNIT and ANTENNA JACK

The 144 MHz unit is built in, and the 2 meter antenna should be installed here.

(3) 50 MHz UNIT and ANTENNA JACK

When the optional 50 MHz unit is installed, the 50 MHz antenna should be connected to this jack.

(4) POWER cord

This is the connection to the AC power line.

(5) GND

For best performance, and protection from dangerous electrical shock, a good earth ground should be connected here, using a short, heavy, braided cable.

(6) RF IN

This jack should be connected to the FT-901DM RF OUT jack, using the supplied Cable A. Do NOT connect this jack to the FT-901DM ANT jack.

(7) ACC

This jack should be connected to the FT-901DM ACC jack, using the supplied Cable C.

(8) HF ANT

The HF antenna should be connected to this jack.

(9) OUTPUT

This jack should be connected to the FT-901DM ANT jack, using the supplied cable B.

(10) EXT RCV

When an external receiver is used, its antenna jack should be connected to this terminal. The connection will be made when the FUNCTION switch is set to EXT RCV. (Connection cable not supplied)

INSTALLATION

Open the packing carton carefully, and save the box and packing material for possible use at a later date. Inspect the FTV-901R for any signs of damage in shipment. If there is visible damage, contact the shipping company immediately, and document the damage thoroughly.

The FTV-901R has been designed for use in many areas of the world, using various AC supply voltages. Therefore, before connecting the FTV-901R to the AC outlet, be absolutely certain that the power specification on the rear of the transverter matches your local supply voltage. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF IMPROPER SUPPLY VOLTAGE. As well, never connect the power cord to a DC power source.

The transverter may be situated in any position without loss of performance. The only constraints regarding installation involve air circulation : the transverter should be located where there is free passage of air around the cabinet and heat sinks.

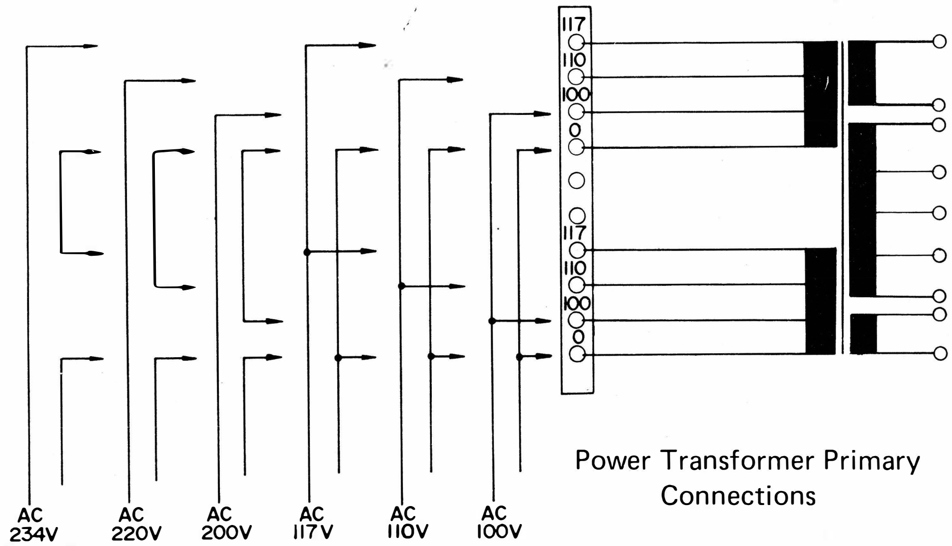
The transverter should be connected to a good earth ground.

Please refer to the drawings for details of correct interconnections between the FTV-901R and the FT-901DM/FT-101ZD and an external receiver, such as the FR-101D.

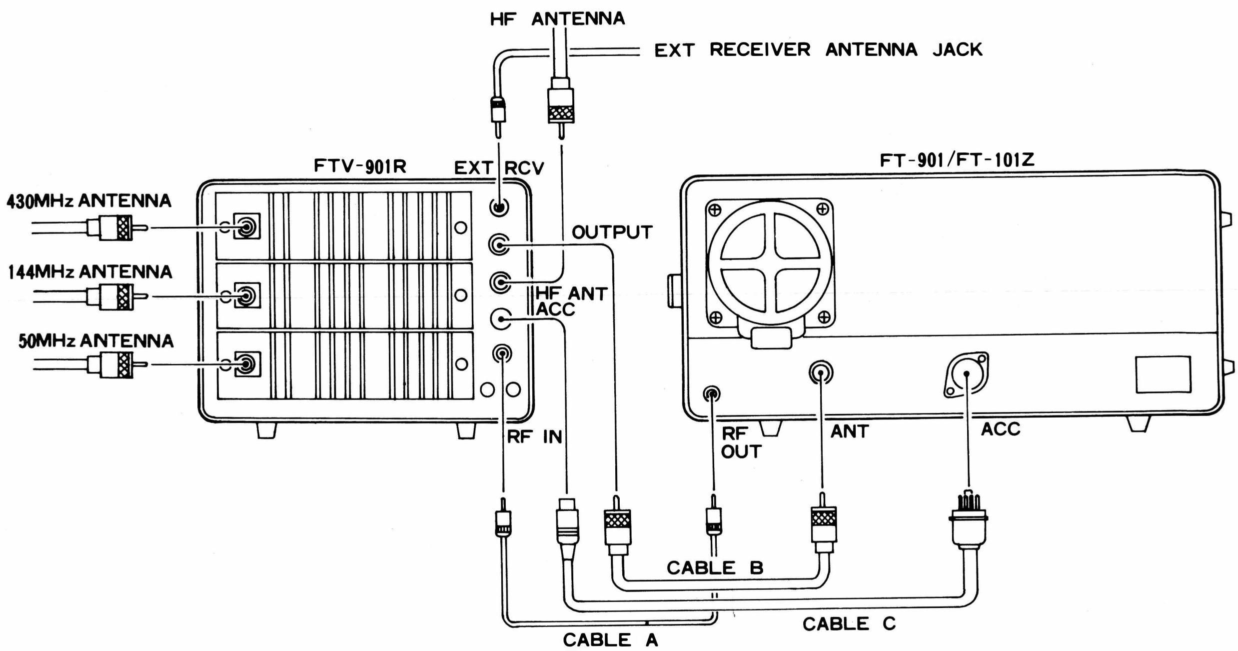
ANTENNA CONSIDERATIONS

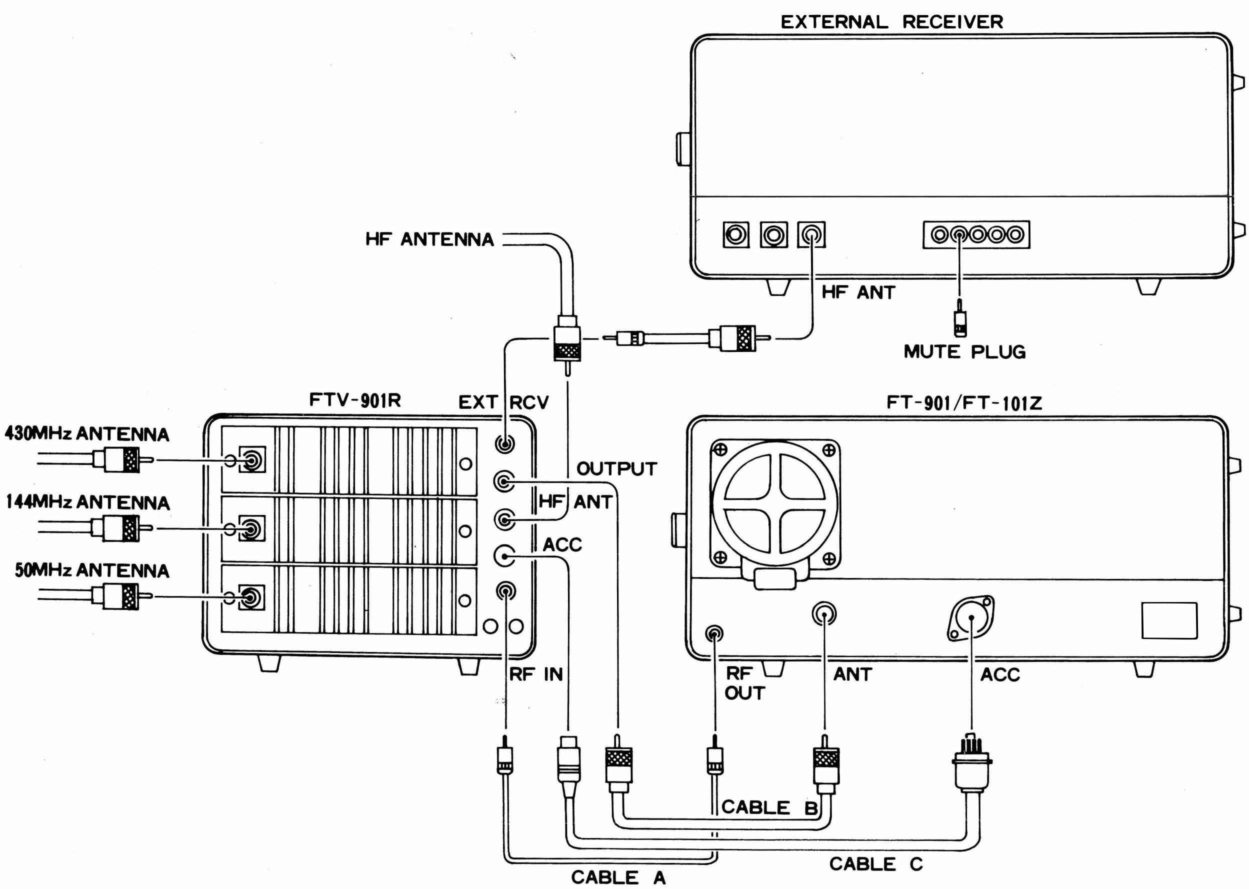
The antenna installation is of critical importance in VHF and UHF installations. For satellite and moonbounce applications, height above ground is not as critical as is the case with local FM installations. A minimum distance of 10 feet should be maintained between the VHF and HF antennas. In all installations, the antenna should be clear of surrounding objects, if the desired pattern is to be obtained.

Do not economize on coaxial cable, as some "bargain" cables have very poor shield coverage, and this may degrade performance significantly. For the 430 MHz antenna, please use a type N connector, as this type provides a constant impedance on the antenna line. For short coaxial runs, we recommend type RG8A/U coax. For very long runs, type RG-17A/U, aluminum-jacketed "foamflex" coax, or air-dielectric "heliax" cables may be used, owing to their very low losses. The SWR on the feedline should be kept below 2 : 1 at all times, to minimize feedline losses.



Power Transformer Primary Connections


HF ANTENNA
EXT RECEIVER ANTENNA JACK
FTV-901R
EXT RCV
FT-901/FT-101Z
430MHz ANTENNA
144MHz ANTENNA
50MHz ANTENNA
OUTPUT
HF ANT
ACC
RF IN
RF OUT
ANT
ACC
CABLE B
CABLE C
CABLE A


EXTERNAL RECEIVER
HF ANTENNA
HF ANT
MUTE PLUG
FTV-901R
EXT RCV
FT-901/FT-101Z
430MHz ANTENNA
144MHz ANTENNA
50MHz ANTENNA
OUTPUT
HF ANT
ACC
RF IN
RF OUT
ANT
ACC
CABLE B
CABLE C
CABLE A

OPERATION

The tuning procedure for the FTV-901R transverter is not complicated. However, care should be exercised in tuning so as not to exceed the ratings of the transverter and HF transceiver. It is assumed that the proper interconnections have been performed, as described on page 7.

The following discussion is tailored to a fully-equipped FTV-901R, including the 50 and 430 MHz units. The reader should note that these are optional units on the standard FTV-901R. The word "option" will hereafter be omitted in the interest of brevity.

INITIAL CHECK

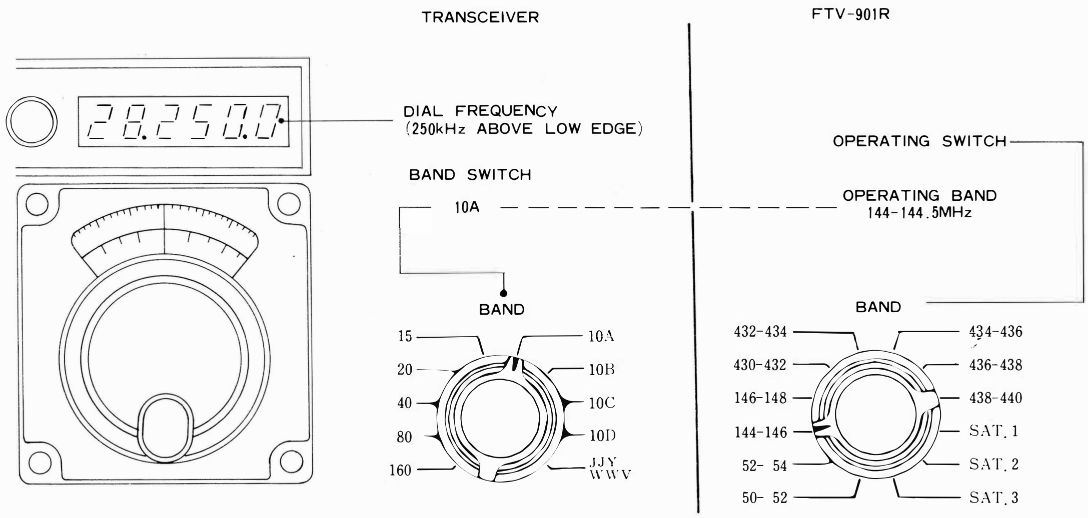
Before connecting the FTV-901R to the power source, confirm that the AC power specification is correct for the supply voltage used, and that a fuse of the proper rating is installed. Check all switches for normal operation. Recheck the interconnections between the HF equipment and the transverter.

FREQUENCY SELECTION

The operating frequency is determined by the position of the main tuning dial and bandswitch of the HF transceiver, as well as the position of the transverter band switch. Please refer to the frequency chart below.

FREQUENCY COVERAGE CHART

	HF TRANSCEIVER BANDSWITCH		10A	10B	10C	10D	
			28.0–28.5	28.5–29.0	29.0–29.5	29.5–30.0	
FTV-901R BANDSWITCH	50–52		50.0–50.5	50.5–51.0	51.0–51.5	51.5–52.0	
	52–54		52.0–52.5	52.5–53.0	53.0–53.5	53.5–54.0	
	144–146		144.0–144.5	144.5–145.0	145.0–145.5	145.5–146.0	
	146–148		146.0–146.5	146.5–147.0	147.0–147.5	147.5–148.0	
	430–432		430.0–430.5	430.5–431.0	431.0–431.5	431.5–432.0	
	432–434		432.0–432.5	432.5–433.0	433.0–433.5	433.5–434.0	
	434–436		434.0–434.5	434.5–435.0	435.0–435.5	435.5–436.0	
	436–438		436.0–436.5	436.5–437.0	437.0–437.5	437.5–438.0	
	438–440		438.0–438.5	438.5–439.0	439.0–439.5	439.5–440.0	
	SAT. 1	TX	144.0–144.5	144.5–145.0	145.0–145.5	145.5–146.0	USB
		RX			29.0–29.5		USB
	SAT. 2	TX	432.0–432.5	432.5–433.0	433.0–433.5	433.5–434.0	USB
		RX	144.0–144.5	144.5–145.0	145.0–145.5	145.5–146.0	LSB
	SAT. 3	TX	144.0–144.5	144.5–145.0	145.0–145.5	145.5–146.0	USB
		RX	434.0–434.5	434.5–435.0	435.0–435.5	435.5–436.0	LSB



OPERATING FREQUENCY = 144.0MHz + 250kHz = 144.250MHz

For example, with the FT-901DM bandswitch set to 10A, and the FTV-901R bandswitch set to 144–146, operation will take place on 144.0–144.5 MHz. By setting the FT-901DM main tuning dial to 28.250.0, operation will take place on 144.250 MHz. See the section on satellite operation for frequency determination on the SAT. bands.

NORMAL TUNE UP

(1) Set the FTV-901R RPT switch to NOR, the METER switch to INPUT, the RCV switch to NOR, the ALC switch to SSB/CW, and the BAND switch to the desired band. The POWER switch should be OFF.

(2) With the transverter off, peak the preselector on the FT-901DM against the marker signal. Be certain that the FT-901DM HEATER switch is ON.

(3) Set the FTV-901R POWER switch to ON.

(4) For 50 or 144 MHz tuning, set the FT-901DM CARR control fully counterclockwise. Push the TUNE button, and slowly advance the CARR control until the FTV-901R meter enters the green zone. Now switch the FTV-901R METER switch to PO, and rotate the TUNE control for a maximum meter reading.

(5) For 430 MHz, there is no peaking procedure for the transverter. With the FT-901DM preselector peaked, the only adjustment that must be made is to set the drive level correctly.

(6) For FM and CW operation, set the ALC switch to SSB/CW. The transceiver CARRIER control may be advanced to the point where the PO does not increase further.

(7) For SSB operation, set the FT-901DM MIC GAIN level so that the FTV-901R INPUT level on the meter does not go past the green zone on the meter scale on voice peaks.

(8) For AM operation, set the ALC switch to AM, and set the METER switch to PO. Advance the transceiver CARRIER control until the meter indicates .3 on the scale. Advance the transceiver MIC GAIN control until the PO meter just begins to move on voice peaks.

(9) Advancement of any of the drive levels beyond the point stipulated in steps (6) through (8) will not increase the power output; component life may, however, be shortened drastically if these input levels are exceeded.

(10) For 6 and 2 meters, rotation of the FTV-901R RF GAIN control will provide adjustment of the gain of the receive converter section. For 430 MHz, this control has no effect, as the converter is always set for maximum gain.

REPEATER OPERATION

When using the FT-901DM transceiver, FM operation on repeaters on 6 and 2 meters is provided. For repeater split, set the RPT switch to the DOWN position for shift of –1 MHz on 6 meters, or –600 KHz for 2 meters. For a shift of +1 MHz or /600 kHz, set the RPT switch to UP.

SATELLITE OPERATION

Operation on the amateur satellites is possible, using an external receiver in addition to the FT-901DM transceiver. The FT-901DM transceiver. The FT-901DM provides the transmit signal, while the external receiver monitors the downlink, on full duplex.

For OSCAR Mode A, transmission takes place on 145.850–145.950 MHz, with reception on 29.400–29.500 MHz. Set the FTV-901R band switch to the SAT. 1 position. Set the FT-901DM band switch to 10D, and tune to 29.850–29.950 MHz. Set the external receiver for reception on 29.400–29.500 MHz.

For OSCAR Mode B, the uplink is 432.125–43.175 MHz, and the downlink is 145.975–145.925 MHz. Set the FTV-901R band switch to the SAT. 2 position. Set the FT-901DM band switch to 10A, and tune to 28.125–28.175 MHz. Set the external receiver for reception on 29.925 MHz. The OSCAR 7 Mode B transponder inverts signals, so an upper sideband signal on the uplink becomes a lower sideband signal on the downlink. Set the mode switches on the FT-901DM and the external receiver appropriately.

For OSCAR Mode J, the uplink is 145.900–146.000 MHz, while the downlink is 435.100–435.200 MHz. Set the FTV-901R band switch to the SAT. 3 position. Set the FT-901DM band switch, to 10D and tune to 29.900–29.999 MHz.

Set the external receiver for reception on 29.6–29.7 MHz. The OSCAR 8 Mode J transponder also inverts signals.

Please note that, because of Doppler effect and other reasons, the frequency translation may not be precisely linear, as might be inferred from the above discussion. Some precise zeroing using the external receiver may be necessary.

Note: When using the FTV-901R on OSCAR Mode J, along with an FT-101 or FR-101 external receiver, a fairly loud spurious signal may be noted at 29.150 MHz on the external receiver (29.150 MHz receive). This is because the fourth harmonic of the local oscillator (35.02 MHz for band 10C), plus the VFO frequency (5.87 MHz), is precisely the transmitting frequency required (145.950 MHz). We recommend that the local crystal frequency be changed to 35.12 MHz.
We regret this inconvenience to you, but the FT-101 and FR-101 series was produced long before OSCAR 8 was conceived. There should be no problem at all when using the FT-901 series or FT-101ZD, etc.

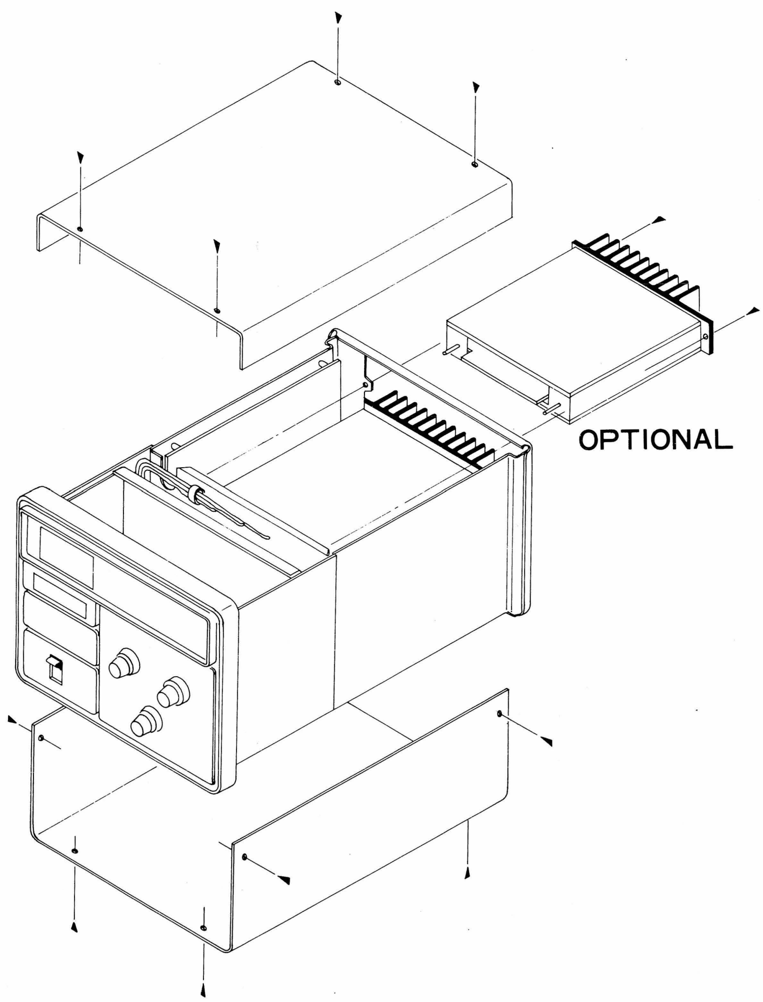
AUXILIARY REPEATER SPLIT INSTALLATION

Should your locality use a repeater split of other than 1 MHz or 600 kHz for six an? two meters, respectively, the correct split can be installed by obtaining an optional crystal (see your Yaesu dealer).

Connect a frequency counter to the cathode of D_{212} (6 meters) of D_{607} (2 meters). Adjust the trimmer capacitors shown in the chart below for the correct frequency.

INSTALLATION OF OPTIONAL MODULES

1. Remove the top and/or bottom cover of the transverter, to allow precise insertion of the unit to be installed.
2. Carefully slide the module into the correct position Do not force the connection.
3. Replace the cabinet covers. Installation is now complete. The module has been carefully aligned at the factory.



CRYSTAL DATA FTV-901R

FUNCTION		HOLDER	RANGE (MHz)	MODE	LOAD C	EFFECTIVE RESISTANCE	DRIVE LEVEL
50 MHz	X_{201}	HC-18/U	22.0	Fundamental	19 pF	15 Ω	2 mW
	X_{202}	〃	24.0	〃	〃	〃	〃
	X_{203}	HC-25/U	23.0	〃	〃	〃	〃
	X_{205}	〃	21.0	〃	〃	〃	〃
144 MHz	X_{601}	HC-18/U	38.666‥	3rd overtone	15 pF	25 Ω	〃
	X_{602}	〃	39.333‥	〃	〃	〃	〃
	X_{603}	HC-25/U	38.866‥	〃	〃	〃	〃
	X_{604}	〃	39.533‥	〃	〃	〃	〃
	X_{605}	〃	38.466‥	〃	〃	〃	〃
	X_{606}	〃	39.133‥	〃	〃	〃	〃
430 MHz	X_{1601}	HC-18/U	67.000	〃	23.5 pF	40 Ω	0.5 mW
	X_{1602}	〃	67.333‥	〃	〃	〃	〃
	X_{1603}	〃	67.666‥	〃	〃	〃	〃
	X_{1604}	〃	68.000	〃	〃	〃	〃
	X_{1605}	〃	68.333‥	〃	〃	〃	〃

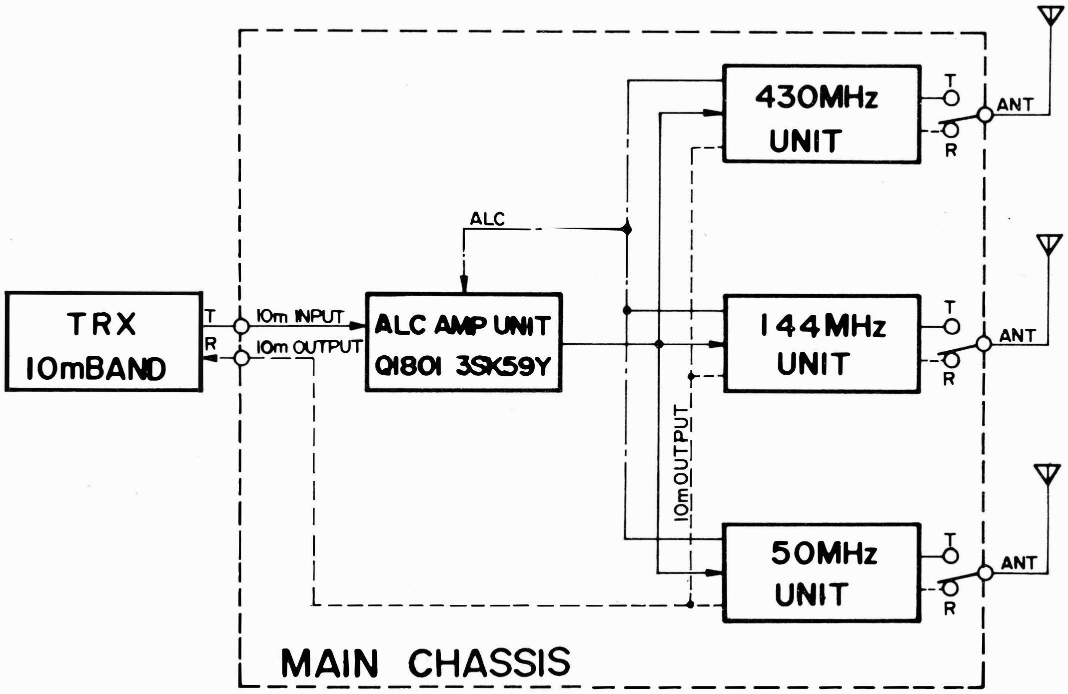
BAND	50MHz		144MHz	
RANGE	50-52	52-54	144-146	146-148
LOCAL FREQUENCY	22MHz(×1)	24MHz(×1)	116MHz(×3)	118MHz(×3)
OSC. FREQUENCY	22MHz ☆	24MHz ☆	38.666···MHz ▲	39.333···MHz ▲

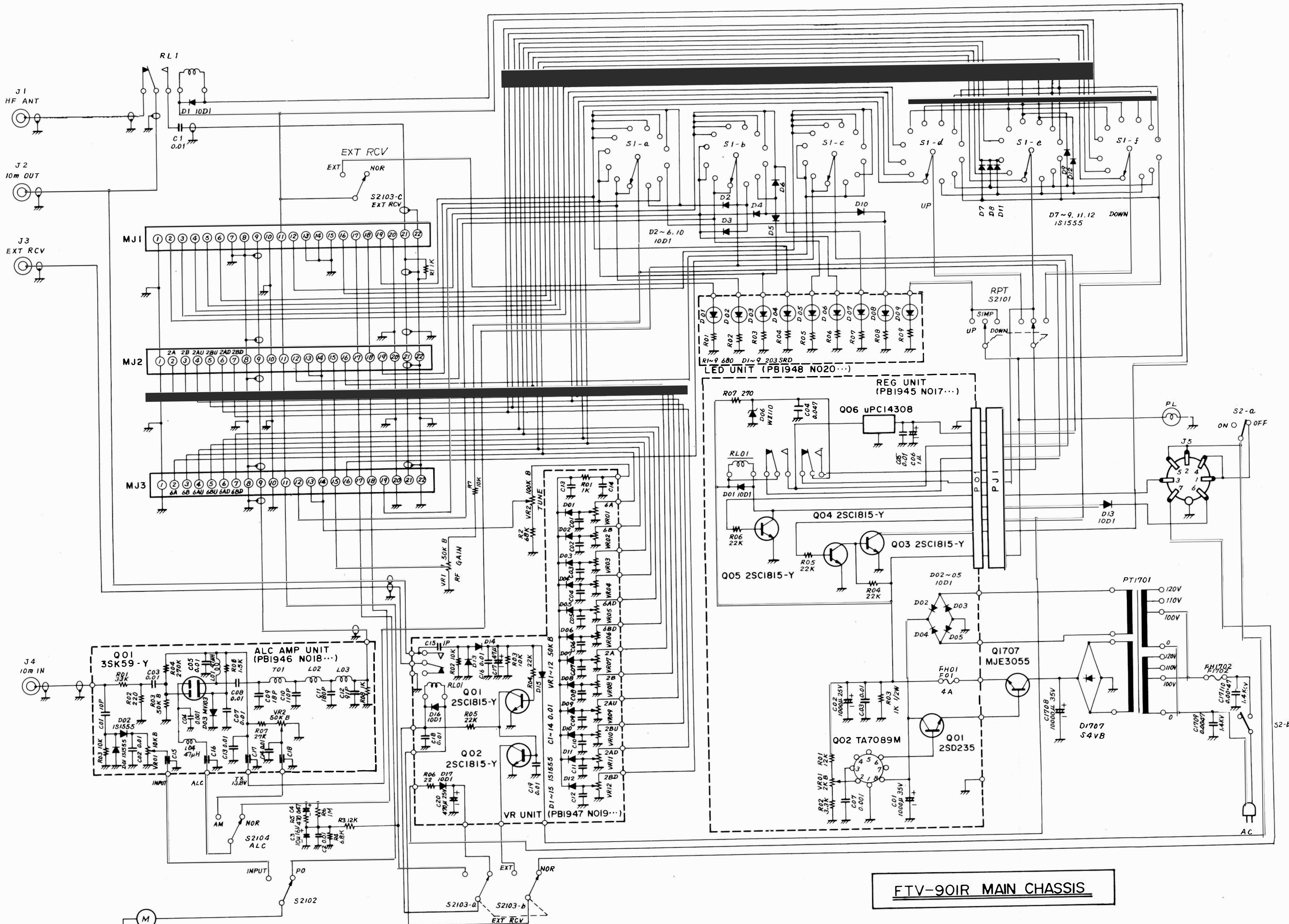
☆FUNDAMENTAL
▲THIRD OVERTONE

BAND	430MHz				
RANGE	430-432	432-434	434-436	436-438	438-440
LOCAL FREQUENCY	402MHz (×3×2)	404MHz (×3×2)	406MHz (×3×2)	408MHz (×3×2)	410MHz (×3×2)
OSC. FREQUENCY	67.000 MHz ▲	67.333···MHz ▲	67.666···MHz ▲	68.000 MHz ▲	68.333···MHz ▲

CIRCUIT DESCRIPTION

The circuit description to follow should help you understand the operation of the FTV-901R transverter. Follow the block diagrams while reading this discussion, and refer to the schematic dagram for specific details.





FTV-901R MAIN CHASSIS
J1 HF ANT
J2 10m OUT
J3 EXT RCV
J4 10m IN
RL1
D1 10D1
C1 0.01
EXT RCV
EXT
NOR
S2103-C EXT RCV
MJ1
MJ2
MJ3
S1-a
S1-b
S1-c
S1-d
S1-e
S1-f
UP
DOWN
D2~6, 10 10D1
D7~9, 11, 12 1S1555
RPT S2101
SIMP
LED UNIT (PB1948 N020···)
R1~9 680 D1~9 203SRD
REG UNIT (PB1945 N017···)
Q06 uPC14308
RL01
D01 10D1
Q04 2SC1815-Y
Q03 2SC1815-Y
Q05 2SC1815-Y
P O 1
P J 1
PL
S2-a
ON
OFF
J5
D13 10D1
D02~05 10D1
PT1701
Q1707 MJE3055
FH01 F01 4A
Q01 2SD235
Q02 TA7089M
D1707 S4VB
FH1702 F1702
S2-b
AC
ALC AMP UNIT (PB1946 N018···)
Q01 3SK59-Y
VR UNIT (PB1947 N019···)
VR1~12 50K B
C1~14 0.01
D1~15 1S1555
Q01 2SC1815-Y
Q02 2SC1815-Y
RL01
VR1 50K B RF GAIN
VR2 100K B TUNE
INPUT
ALC
TX 13.8V
AM
NOR
S2104 ALC
INPUT
PO
S2102
M
S2103-a
S2103-b
EXT RCV

50 MHz UNIT

The 50 MHz signal from the antenna is fed through a low-pass filter, consisting of C_{323}, C_{324}, L_{312}, and L_{313}, to RL_{301}. On receive, the signal is amplified by Q_{205} (3SK51) and fed through a selective bandpass filter, which is tuned to the operating frequency by varactor diodes D_{210} and D_{211} (1S2209). The second gate of Q_{205} is connected through a large resistor to the front panel RF GAIN control, allowing variation in the gain of the RF amplifier.

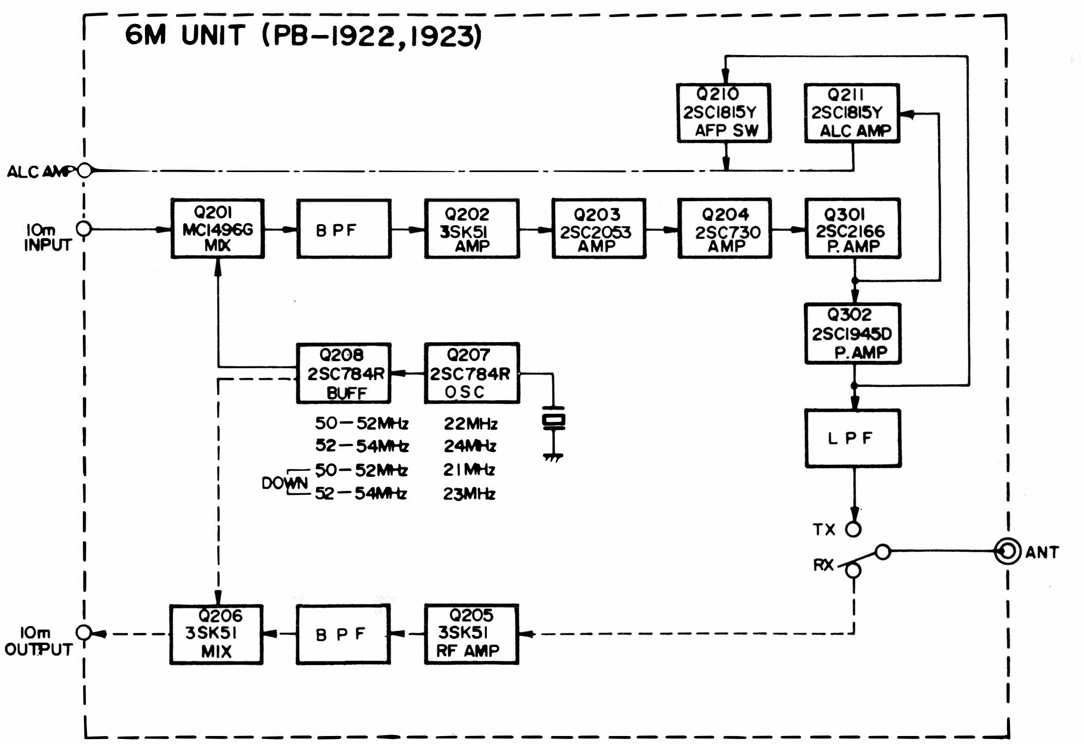
The signal is then fed to the mixer, Q_{206} (3SK51), where the 50–54 MHz signal is mixed with a local signal of 22 or 24 MHz, producing an IF signal of 28–30 MHz which is fed through a diode switch to the 10 M OUTPUT jack.

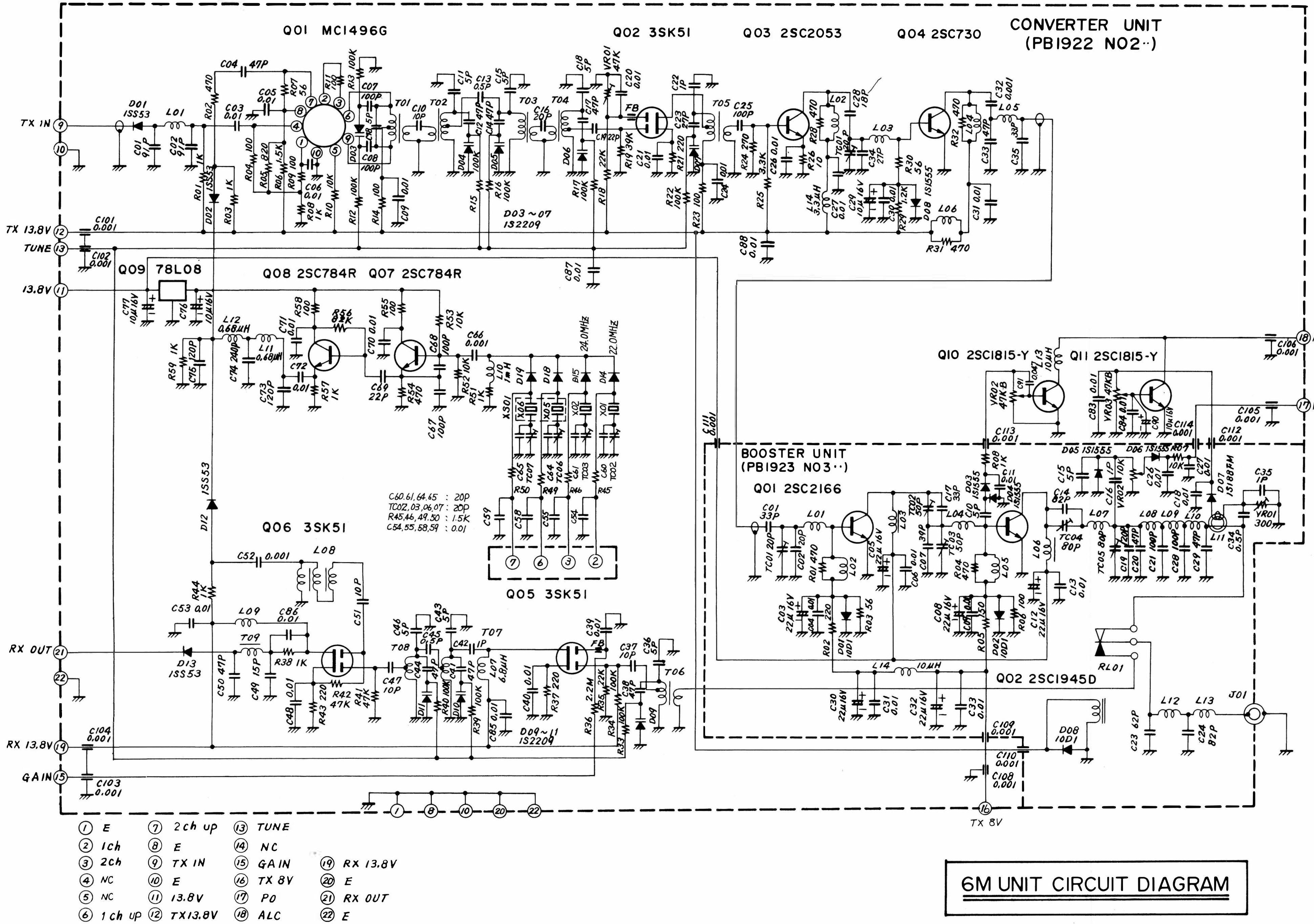
The local signal is generated by crystal oscillator Q_{207} (2SC784R), and amplified by Q_{208} (2SC784R). For repeater operation, the local signal is shifted up or down 1 MHz, according to the position of the front panel RPT switch.

For transmission, the 28–30 MHz output signal from the transceiver is fed to the balanced mixer, Q_{201} (MC1496G), where it is mixed with the local signal delivered from Q_{208}. The 50–54 MHz signal is then passed through a selective bandpass filter, which effectively eliminates spurious signals. The signal is then amplified by the amplifier chain, consisting of Q_{202} (3SK51), Q_{203} (2SC2053), Q_{204} (2SC730) Q_{301} (2SC2166), and Q_{302} (2SC1945D). The output signal of approximately 10 watts is then fed, via a low pass filter, to the ANT jack.

A portion of the output from Q_{301} is detected by D_{303} and D_{304} (1S1555), and the resulting DC voltage is amplified by Q_{211} (2SC1815Y) for ALC purposes. A portion of the output from L_{311} is detected by D_{306} and fed to the base of Q_{211}, controlling the bias of Q_{211} and Q_{302}. Q_{210} (2SC1815Y) works as a switch for the automatic final protection circuit, which will reduce the gain of the amplifier transistors in case of high SWR. A further portion of the output is detected by D_{305} (1S1555) and fed to the meter, for an indication of relative power output.

Q_{309} (78L08) regulates the supply voltage at 8 volts for the transistors.





6M UNIT CIRCUIT DIAGRAM

144 MHz UNIT

The incoming 144 MHz signal is fed through a low-pass filter, consisting of L_{708}, C_{716}, and C_{717} to RL_{701}. On receive, the signal is amplified by Q_{605} **(3SK51)**. The output from Q_{605} is fed through a 4-stage bandpass filter. Gate 2 of the RF amplifier is connected through a large resistor to the front panel RF GAIN control.

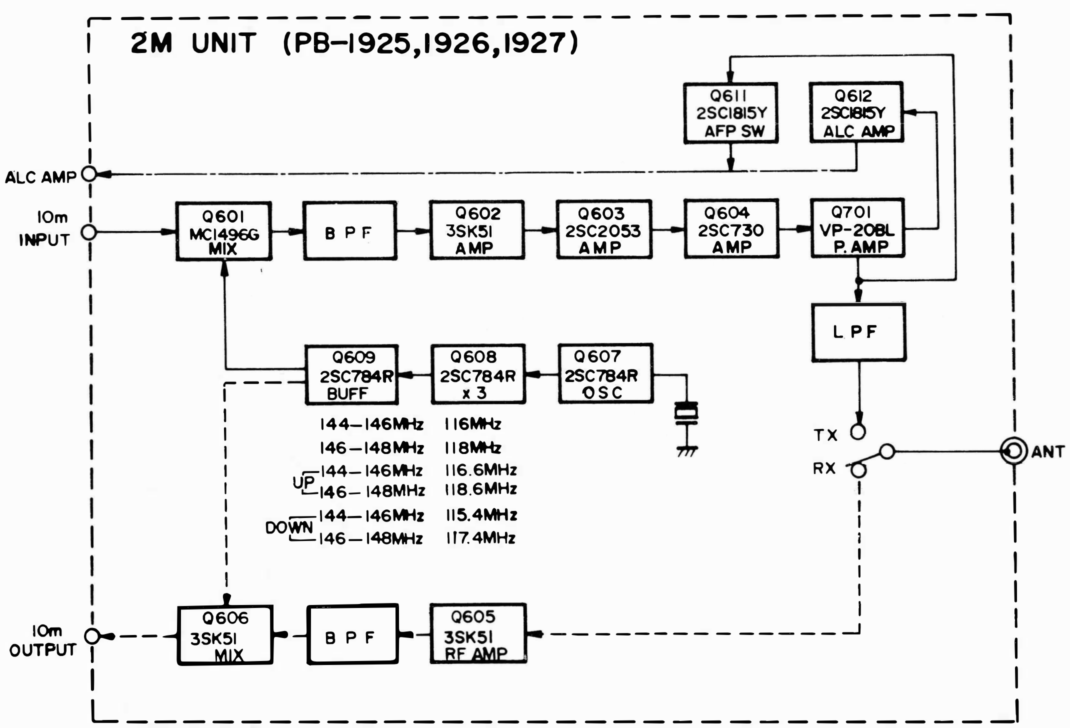
The signal is then fed to the mixer, Q_{606} **(3SK51)**, where the incoming signal is heterodyned with a local signal of 116 or 118 MHz, producing an IF signal of 28–30 MHz which is fed through a diode switch to the 10 M OUTPUT jack.

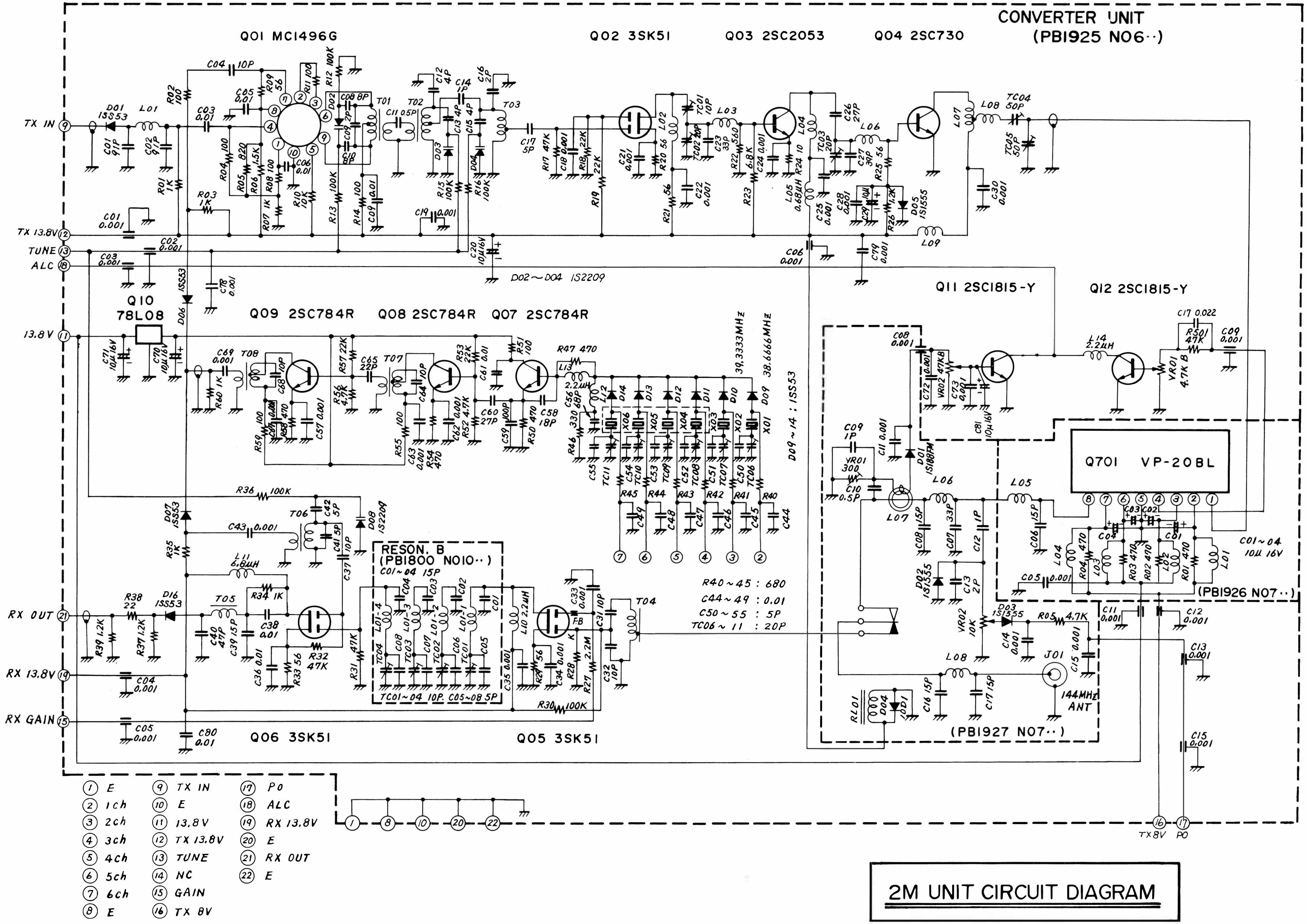
The local signal is generated at 38.666 MHz by Q_{607} **(2SC784R)**, then delivered to tripler Q_{608} **(2SC784R)**, then delivered through buffer Q_{609} **(2SC784R)** to gate 2 of Q_{606}. For repeater operation, the local signal is shifted up or down 600 kHz, depending on the position of the front panel RPT switch.

For transmission, the 28–30 MHz input signal is fed to Q_{601} **(MC1496G)**, where it is mixed with the local signal delivered from Q_{609}. The 144–148 MHz signal is then fed through a selective bandpass filter, which is tuned to the operating frequency by varactor diodes D_{602}, D_{603}, and D_{604} **(1S2209)**, thus effectively eliminating spurious responses. The signal is then amplified by the amplifier chain, consisting of Q_{602} **(3SK51)**, Q_{603} **(2SC2053)**, and Q_{604} **(2SC730)**, and delivered to the final amplifier, Q_{701} **(VP-20BL)**.

A portion of the output signal at the power module is amplified by Q_{612} **(2SC1815Y)** for ALC purposes. A portion of the output signal is also fed to Q_{611} **(2SC1815Y)**, which acts as a switch for the AFP circuit, which will protect Q_{701} from damage caused by high SWR. A further portion of the output is detected by D_{702} **(1S1555)** and fed to the meter, for an indication of relative power output.

The supply voltage is regulated at 8 volts by Q_{510} (78L08).





2M UNIT CIRCUIT DIAGRAM

430 MHz UNIT

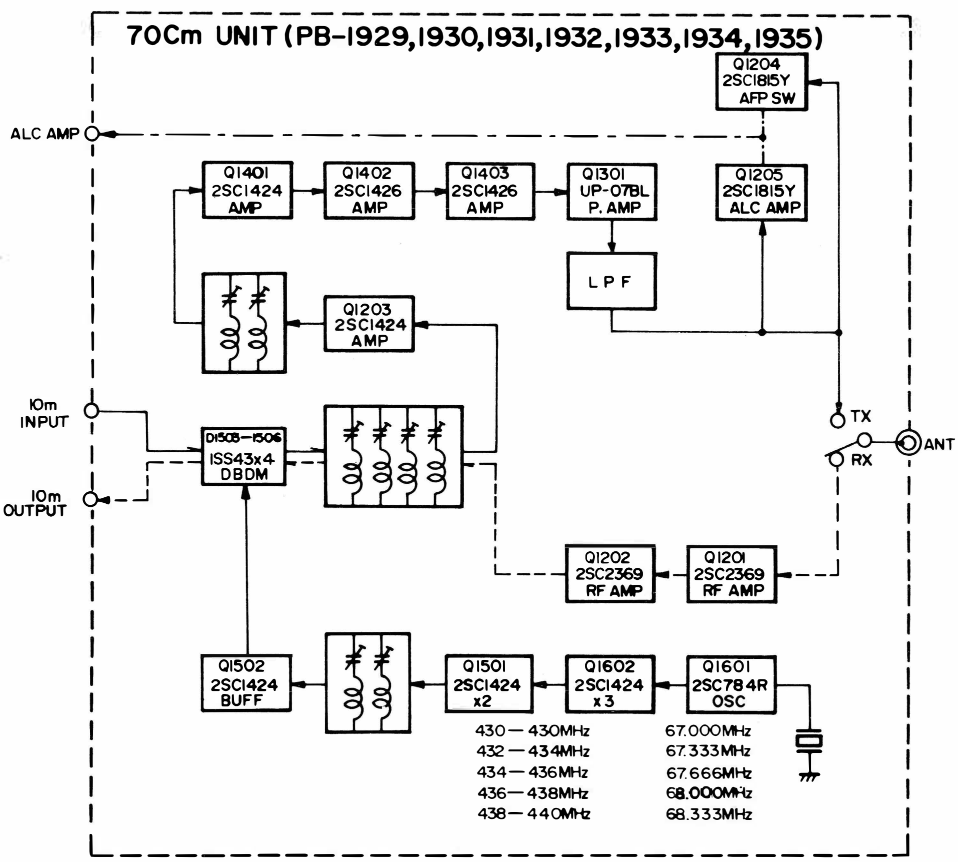
The incoming signal is fed through RL_{1301} to the two stage RF amplifier, consisting of Q_{1201} and Q_{1202} **(2SC2369)**, and then passed through a selective filter to the doubly balanced diode mixer, D_{1503}–D_{1506} **(1SS43)** where the incoming signal is mixed with a 402–410 MHz local signal, producing a 28–30 MHz output signal which is fed to the 10 M OUTPUT jack.

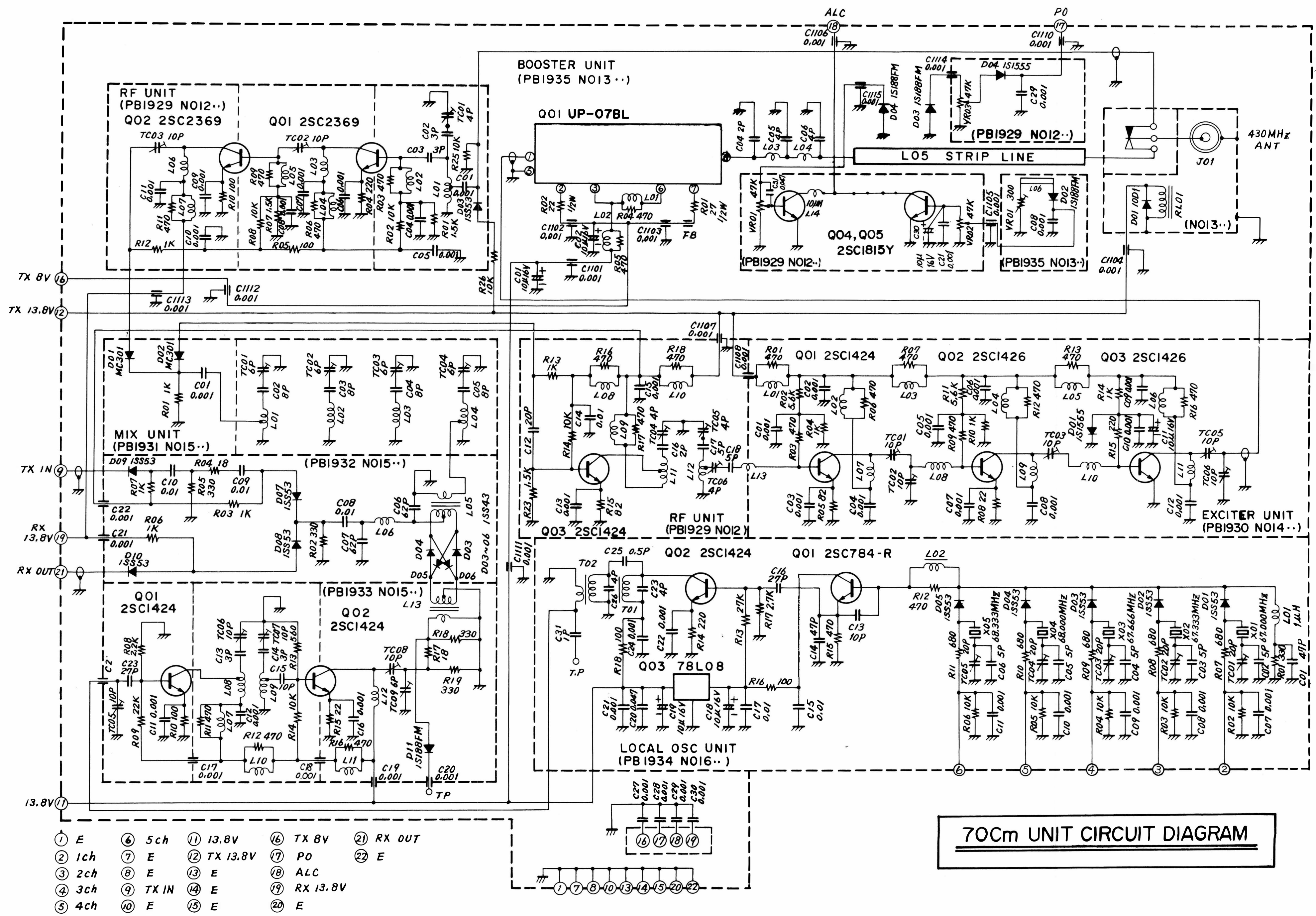
The local signal is generated at 67–68 MHz by oscillator Q_{1601} **(2SC784R)**, then multiplied by Q_{1602} and Q_{1501} **(2SC1424)**. The local signal at 402–410 MHz is then passed through a selective filter to buffer Q_{1502} **(2SC1424)**, for delivery to the mixer.

For transmission, the output from the transceiver is delivered to the diode ring mixer, where it is heterodyned with the local oscillator signal, resulting in a signal of 430–440 MHz. The signal is then fed through a selective filter, which effectively eliminates spurious responses. The signal is then amplified by Q_{1203} **(2SC1424)**, fed through another selective filter, then amplified by the amplifier chain, consisting of Q_{1401} **(2SC1424)**, Q_{1402} **(2SC1426)**, Q_{1403} **(2SC1426)**, and final amplifier Q_{1301} **(UP-07BL)**. The output signal from Q_{1301} is fed through a stripline filter, via RL_{1301}, to the ANT jack.

A portion of the output from L_{1306} is detected by D_{1302} **(1S188FM)** and fed to the base of Q_{1205} **(2SC1815Y)**, for control of the bias applied to Q_{1301}. Q_{1204} **(2SC1815Y)** acts as a switch for the automatic final protection circuit. A further portion of the output signal is rectified by D_{1303} **(1S188FM)** and fed to the meter, providing indication of relative power output.

The supply voltage is regulated at 8 volts by Q_{1603} **(78L08)**.





70Cm UNIT CIRCUIT DIAGRAM

ALC CIRCUIT

The 28 MHz input signal from the transceiver is fed to the ALC AMP unit, where it is amplified by Q_{1801} **(3SK59Y)**. Gate 1 receives the RF signal, while gate 2 is connected to the ALC voltage supplied from the various modules. The ALC voltage is used to control the gain of Q_{1801}. In the AM mode, the ALC level is fixed, and no connection is made to the modules for the individual bands.

A portion of the input signal is detected by D_{1801} and D_{1802} **(1S1555)**, for an indication of the input level on the meter.

SWITCHING CIRCUITS

(1) POWER switch OFF

Heater voltage from the transceiver appears at the ACC connector, when proper connections are made to the FTV-901R. When the transceiver heater switch is ON, and the FTV-901R power switch is OFF, RL_1 is set to OFF, and the 10 m OUT jack is connected to the HF ANT jack, permitting normal HF operation. After the transverter is turned off, a warmup time of approximately 1 minute is required to allow the transceiver tubes to reach operating temperature.

(2) POWER switch ON

When the FTV-901R is turned on, voltage is applied to relay driver Q_{1703} **(2SC1815Y)** turning it on. With the conduction of Q_{1703}, RL_1 is activated, connecting the 10 meter output to the various units of the transverter, according to the position of the bandswitch. When the heater switch is on, and the FTV-901R is not in use, RL_{1901} switches the external receiver to the HF antenna on receive.

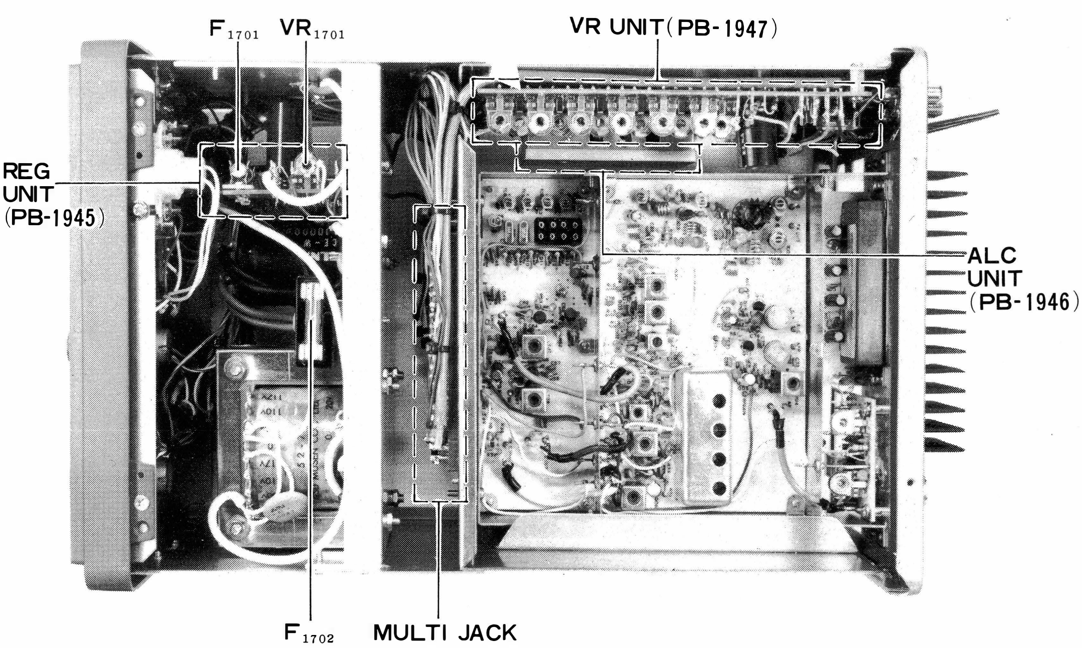
When the heater switch is turned off, Q_{1902} **(2SC1815Y)** is switched on, switching the EXT RCV jack to be in parallel with the HF ANT jack, allowing monitoring on the external receiver. If the external receiver is not normally used for monitoring, the heater switch should always be left on.

POWER SUPPLY

The AC voltage from the power transformer is rectified by bridge rectifier, and stabilized at 13.8 volts by Q_{1707} **(MJE3055)**, Q_{1701} **(2SD235)**, and Q_{1702} **(TA7089M)**. This voltage is used for the LED UNIT, pilot lamps, and the three converter units.

D_{1706} **(WZ110)** provides 11 volts for the local oscillator diode switch circuits, while Q_{1706} **(μPC14308)** regulates the 13.8 volt line from RL_{1701} for the low voltage circuits.

On the VR UNIT, diode switches D_{1901}–D_{1912} **(1S1555)** select voltage regulating potentimeters VR_{1901}-VR_{1912}, for tuning the varactor-diode-tuned circuits in the various units.



MAINTENANCE AND ALIGNMENT

The FTV-901R has been carefully aligned and tested at the factory prior to shipment. With normal use, if the unit is not abused, the FT-901R will provide many years of trouble-free operation.

Sudden difficulties are usually the result of parts failures, rather than alignment problems. Therefore, alignment should not be undertaken unless the operation of the transverter is completely understood, the fault has been throughly diagnosed, and the trouble has been definitely traced to misalignment rather than part failure. Attempts to align this equipment by other than an experienced technician are discouraged.

For alignment purposes, a VTVM with RF probe good to 450 MHz is required. Also, a signal generator good to 450 MHz, and a frequency counter good to 250 MHz are required. A dummy load and wattmeter good to 450 MHz are also required.

REG UNIT (PB-1975)

Connect a DC voltmeter to pin 11 of multijack MJ1, 2, or 3. Adjust VR_{1701} for a reading of 13.8 volts.

ALC AMP UNIT (PB-1946)

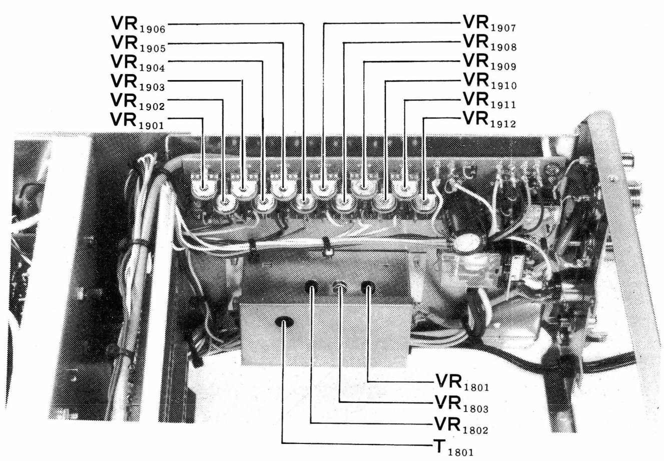
(1) Set the HF transceiver to 29 MHz, CW mode.

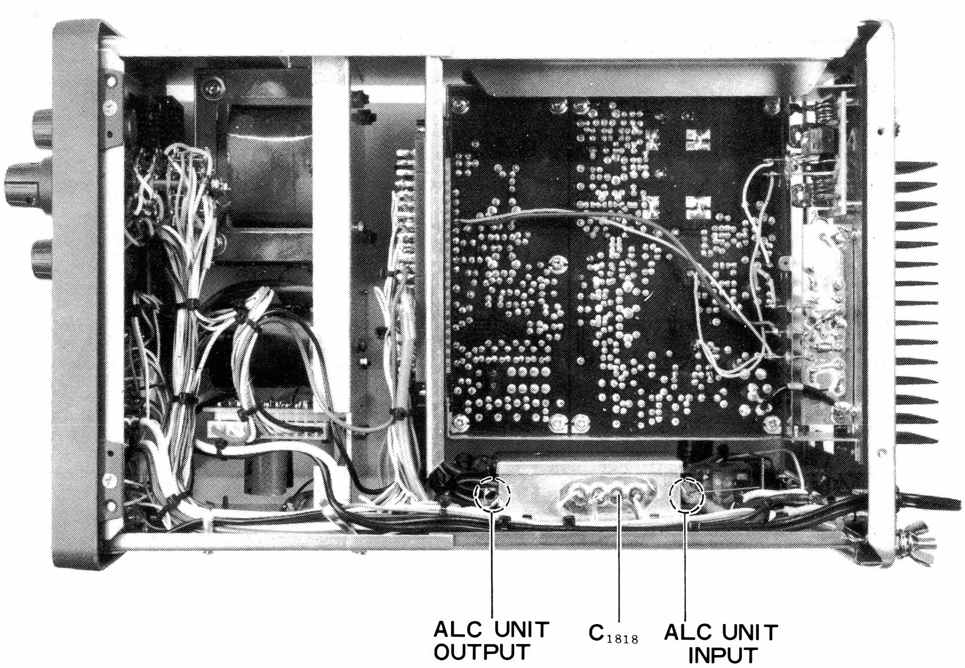
(2) Connect the RF probe of the VTVM to the input of the ALC AMP unit, and adjust the HF transceiver DRIVE or CARRIER control for an output of 3 volts RMS while transmitting.

(3) Connect the DC voltmeter between the hot lead and case of C_{1818}. Set the ALC meter to AM. Adjust VR_{1802} for a reading of 5 volts on the voltmeter.

(4) Connect the RF probe of the VTVM to the output of the ALC AMP unit. Adjust T_{1801} for a maximum VTVM indication. Adjust VR_{1803} for a maximum VTVM indication (0.7 volts nom.).

(5) Set the FTV-901R meter switch to INPUT. Adjust VR_{1801} for a reading of .2 on the meter.





50 MHz UNIT

Please remove the 144 and 430 MHz units, if installed, to allow access to test points on the 50 MHz module.

1. Local oscillator circuit

(1) Connect the DC voltmeter to pin 2 of the edge connector for the 50 MHz unit. Confirm that 11 volts is present, with the BAND switch set to 50–52 MHz. Switch to 52–54 MHz, and check for 11 volts at pin 3 of the edge connector.

(2) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Confirm that the unit is oscillating.

(3) Connect a frequency counter to the LOCAL OUT terminal. Set the BAND switch to 50–52 MHz, set the RPT switch to SIMP, and adjust T_{202} for a reading of exactly 22.0 MHz. Switch to 52–54 MHz, and adjust TC_{203} for a reading of 24.0 MHz.

2. Receiver section

(1) Set the HF transceiver to 29 MHz, and peak the preselector against the marker signal for maximum sensitivity.

(2) Connect the DC voltmeter to pin 19 of the edge connector, set the BAND switch to 50–52 MHz, then 52–54 MHz, and confirm that 13.8 volts is present.

(3) Connect the DC voltmeter to pin 15 of the edge connector, and rotate the FTV-901R RF GAIN control fully counterclockwise. The voltmeter reading should be 0 volts. In the fully clockwise position, it should be 13.8 volts. After confirming these voltages, please leave the level at maximum gain.

(4) Connect the DC voltmeter to pin 14 of the edge connector, and set the FTV-901R TUNE control to the center position (12 o' clock). With the BAND switch in the 50–52 MHz position, adjust **VR_{1901}** for a reading of 4 volts.

(5) Connect a signal generator to the 50 MHz ANT jack, and set the FTV-901R BAND switch to 50–52 MHz. Set the signal generator to 51 MHz, and tune the receiver to its output.Peak VR_{1902} T_{206} ,T_{207} ,T_{208} ,and T_{209} for a maximum reading on the HF transceiver S-meter. Reduce the signal generator output, if necessary, to secure easy viewing of the peak point. Switch to the 52–54 MHz band, set the signal generator output to 53 MHz, and repeak these transformers again while tuned to the generator frequency. Then recheck the results at 51 MHz.

3. Transmitter section

(1) Connect a dummy load/wattmeter to the 50 MHz ANT jack. Set VR_{202} and VR_{203} fully counterclockwise. Set the HF transceiver DRIVE or CARRIER control to the center its range (12 o'clock). Set the BAND switch to 50–52 MHz.

(2) Connect the RF probe of the VTVM to the collector of Q_{203}. While transmitting, peak T_{201}, T_{202}, T_{203}, T_{204}, and T_{205} for a maximum reading on the VTVM (0.4 volts RMS nom.).

(3) Connect the RF pbobe to terminal A on the 50 MHz unit. Peak TC_{201} and L_{205} for a maximum reading on the VTVM (4 volts RMS nom.).

(4) While transmitting, peak TC_{201}, TC_{202}, TC_{203}, TC_{204}, and TC_{205} for a maximum power output indication on the wattmeter.

(5) Repeat steps (2) through (4) on the 52–54 MHz band. Then recheck the results at 50–52 MHz.

(6) Set the FTV-901R meter switch to the PO position, and set the transceiver DRIVE or CARRIER control for an output of 12 watts from the transverter. Set VR_{302} for a reading of .8 on the FTV-901R meter.

(7) Beginning at zero drive, gradually increase the transceiver DRIVE or CARRIER control until the output from the transverter does not increase more. Do not exceed this level.

(8) Rotate VR_{202} slowly clockwise, until an output of 12 watts is secured across the 50–54 MHz range.

(9) Set VR_{203} fully clockwise.

(10) While transmitting, rotate VR_{301} to secure maximum power output on the wattmeter.

(11) Now rotate VR_{203} fully counterclockwise. While transmitting, rotate VR_{203} slowly clockwise, until the power output just begins to fall off. Do not go past the threshold point.

(12) Remove the dummy load from the antenna jack. While transmitting, confirm that the PO indication is .2 with no load applied. If not, check the AFP circuit for malfunctioning part.

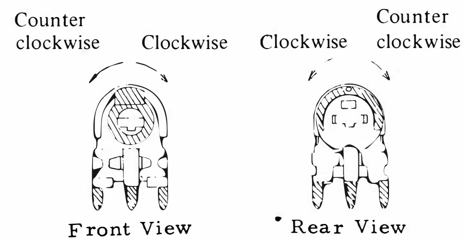
(13) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Set the BAND switch to 50–52 MHz, then switch the repeater switch to UP and DOWN. Confirm that oscillation is taking place. Repeat on 52–54 MHz.

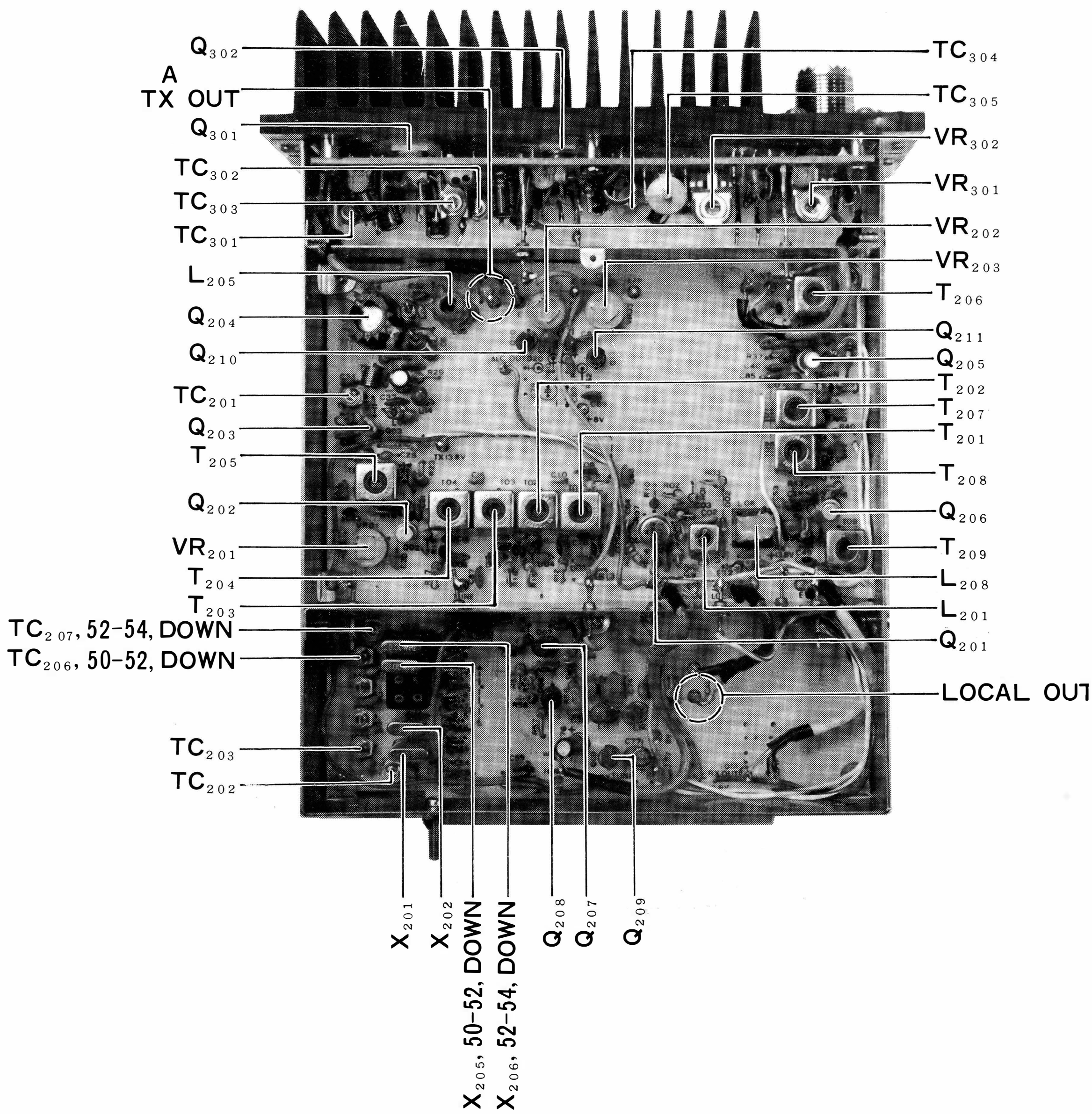
(14) Connect the frequency counter to the LOCAL OUT terminal. Adjust TC_{204}–TC_{206} as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	FREQUENCY
50-52	DOWN	TC_{206}	21.0MHz
52-54	DOWN	TC_{207}	23.0MHz

(15) Set the TUNE control to the center of its range. Adjust the potentiometers for maximum power output while transmitting into the dummy load, as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	RESULT
50-52	DOWN	VR_{1905}	MAXIMUM OUTPUT
52-54	DOWN	VR_{1906}	





144 MHz UNIT

Please remove the 50 and 430 MHz units, if installed, to allow access to test points on the 144 MHz odule.

1. Local oscillator circuit

(1) Connect the DC voltmenter to pin 2 of the edge connnector for the 144 MHz unit. Confirm that 11 volts is present, with the BAND switch set to 144–146 MHz. Switch to 146–148 MHz, and check for 11 volts at pin 3 of the edge connector.

(2) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Confirm that the unit is oscillating.

(3) Connect a frequency counter to the LOCAL OUT terminal. Set the BAND switch to 144–146 MHz, set the RPT switch to SIMP, and adjust TC_{606} for a reading of exactly 116.0 MHz. Switch to 146–148 MHz, and adjust TC_{607} for a reading of 118.0 MHz.

2. Receiver section

(1) Set the HF transceiver to 29 MHz, and peak the preselector against the marker signal for maximum sensitivity.

(2) Connect the DC voltmeter to pin 19 of the edge connector, set the BAND switch to 144–146 MHz, the 146–148 MHz, and confirm that 13.8 volts is present.

(3) Connect the DC voltmeter to pin 15 of the edge connector, and rotate the FTV-901R RF GAIN control fully counterclockwise. The voltmenter reading should be 0 volts. In the fully colckwise position, it should be 13.8 volts. After confirming these coltages, please leave the level at maximum gain.

(4) Connect the DC voltmeter to pin 14 of the edge connector, and set the FTV-901R TUNE control to the center position (12 o'clock). With the BAND switch in the 144–146 MHz position, adjust VR_{1907} for a reading of 4 volts. Switch to 146–148 MHz, and adjust VR_{1908} for a reading of 4 volts.

(5) Connect a signal generator to the 144 MHz ANT jack, and set the FTV-901R BAND switdh to 144–146 MHz. Set the signal generator to 145 MHz, and tune the receiver to its output. Peak TC_{1001}–TC_{1004}, T_{604}–TC_{606}, for a maximum reading on the HF transceiver S-meter. Reduce the signal generator output, if neces- sary, to secure easy viewing of the peak point. Switch to the 140–148 MHz band, set the signal generator output to 147 MHz, and repeak these transformers again while tuned to the generator frequency. Then recheck the results at 145 MHz.

3. Transmitter section.

(1) Connect a dummy load/wattmeter to the 144 MHz ANT jack. Set VR_{601} and VR_{602} fully counterclockwise. Set the HF transceiver DRIVE or CARRIER control to the center of its range (12 o'clock). Set the BAND switch to 144–146 MHz.

(2) Connect the RF probe of the VTVM to the collector of Q_{603}. While transmitting, peak T_{601}–T_{603}, TC_{601}, and TC_{602} for a maximum reading on the VTVM (0.9 volts RMS nom.).

(3) Connect the RF probe to terminal A on the 144 MHz unit. Peak TC_{604} and TC_{605} for a maximum reading on the VTVM (2.5 volts RMS nom.).

(4) Repeat steps (2) and (3) on the 146–148 MHz band. Then recheck the results at 144–146 MHz.

(5) Set the FTV-901R meter switch to the PO position, and set the transceiver DRIVE or CARRIER control for an output of 12 watts from the transverter. Set VR_{702} for a reading of .8 on the FTV-901R meter.

(6) Beginning at zero drive, gradually increase the transceiver DRIVE or CARRIER control until the output from the transverter does not increase more. Do not exceed this level.

(7) Rotate VR_{601} slowly clockwise, until an output of 12 watts is secured across the 144–148 MHz range.

(8) Rotate VR_{602} fully clockwise.

(9) While transmitting, rotate VR_{701} to secure maximum power output on the wattmeter.

(10) Now rotate VR_{602} fully counterclockwise. While transmitting, slowly rotate VR_{602} clockwise, until the power output just begins to fall off. Do not go past the threshold point.

(11) Remove the dummy load from the antenna jack. While transmitting, confirm that the PO indication is .2 with no load applied. If not, check the AFP circuit for malfunctioning parts.

(12) Connect the RF probe of the VTVM to the LOCAL OUT terminal. Set the BAND switch to 144–146 MHz, then switch the repeater switch to UP and DOWN. Confirm that oscillation is taking place. Repeat on 146–148 MHz.

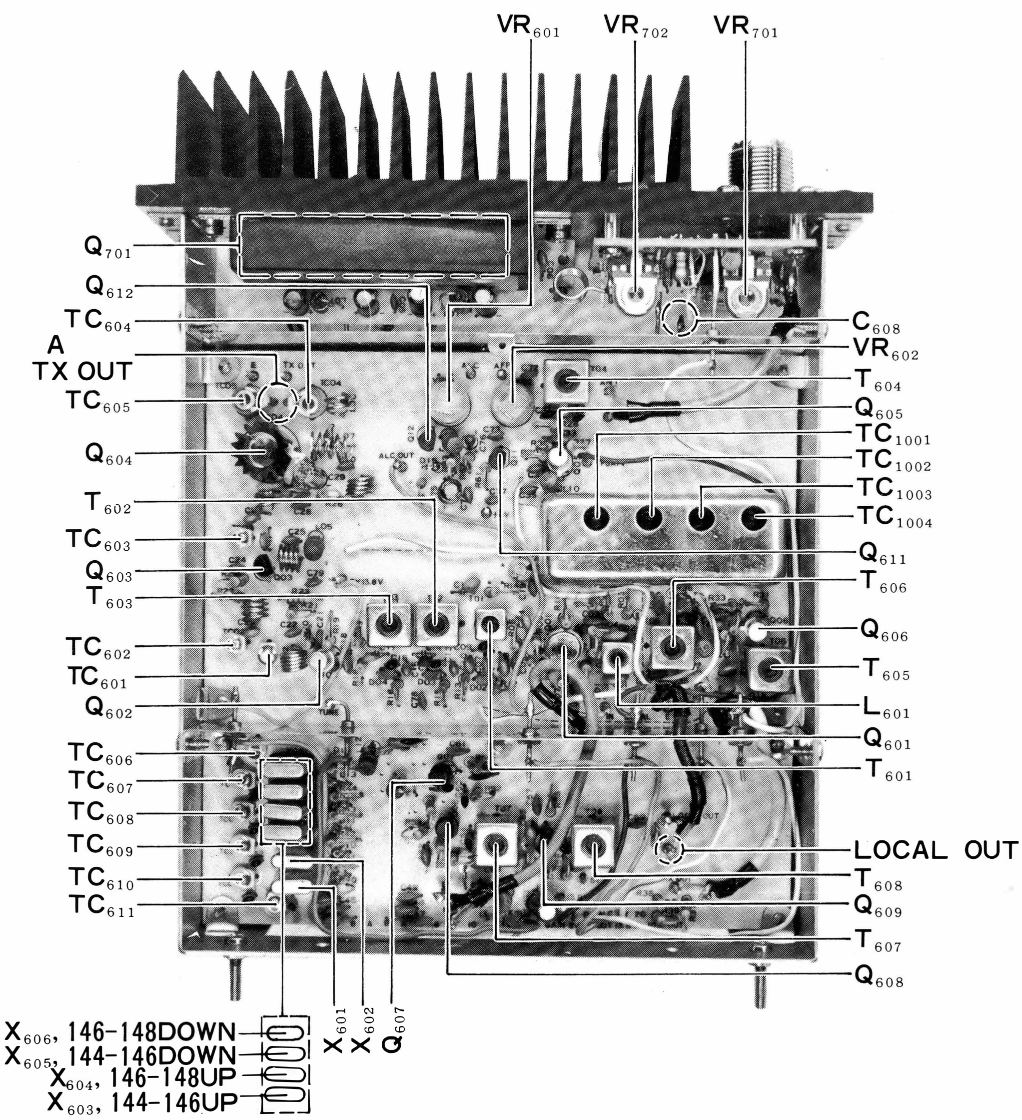
(13) Connect the frequency counter to the LOCAL OUT terminal. Adjust TC_{608}–TC_{611} as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	FREQUENCY
144-146	UP	TC_{608}	116.6MHz
	DOWN	TC_{610}	115.4MHz
146-148	UP	TC_{609}	118.6MHz
	DOWN	TC_{611}	117.4MHz

(14) Set the TUNE control to the center of its range. Adjust the potentiometers for maximum power output while transmitting into the dummy load, as shown in the chart below.

BAND SWITCH	RPT SWITCH	ADJUST	RESULT
144-146	UP	VR_{1909}	MAXIMUM OUTPUT
	DOWN	VR_{1911}	
146-148	UP	VR_{1910}	
	DOWN	VR_{1912}	

(15) Adjust T_{607} and T_{608} for identical power output with the RPT switch in the UP and DOWN positions.



430 MHz UNIT

Please remove the 50 and 144 MHz units, if installed, to allow access to test points on the 430 MHz unit.

1. Local oscillator circuit

(1) Connect a DC voltmeter to pin 2 of the edge connector for the 430 MHz unit. Set the BAND switch to 430–432, and confirm that 11 volts is present. In turn, check pins 3, 4, 5, and 6 for 11 volts, while switched to the 432–434, 434–436, 436–438, and 438–440 MHz bands, respectively.

(2) Connect the RF probe of the VTVM to TP_1, and adjust L_{1602}, T_{1601}, and T_{1602} for maximum indication on the VTVM.

(3) Connect the frequency counter to TP_1. Refer to the chart below, and adjust TC_{1601}–TC_{1605} for local output readings as shown for the various positions of the BAND switch.

(4) Connect the DC voltmenter to TP_2, and adjust TC_{1505}–TC_{1509} for maximum indication on the voltmeter (1 volt nom.).

2. Receiver section

(1) Set the transceiver to 29 MHz, and peak the receiver preselector against the marker signal for maximum sensitivity.

(2) Connect the DC voltmeter to pin 19 of the edge connector, and check for 13.8 volts at each position of the BAND switch over 430–440 MHz.

(3) Connect the signal generator to the 430 MHz ANT jack, set its output to 431 MHz, and tune the receiver to the generator signal. Adjust TC_{1201}–TC_{1203} and TC_{1501}–TC_{1504} for a maximum S-meter indication on the HF transceiver. Repeat on 433 MHz, 435 MHz, 437 MHz, and 439 MHz. Recheck the results to ensure maximum response across the entire operating range.

3. Transmitter section

(1) Connect the dummy load/wattmeter to the 430 MHz ANT jack. Set VR_{1201} and VR_{1202} fully counter clockwise. Set the transceiver DRIVE or CARRIER control to the center of its range (12 o'clock position).

(2) Connect the RF probe of the VTVM to the cathode of D_{1502}. Peak TC_{1501}–TC_{1504} for a maximum indication on the VTVM while transmitting.

(3) Connect the RF probe of the VTVM to the hot side of L_{1213}. Peak TC_{1203}–TC_{1206} for a maximum indication on the VTVM.

(4) Connect the RF probe of the VTVM to terminal A on the 430 MHz unit. Peak TC_{1401}–TC_{1406} for a maximum indication on the VTVM.

(5) Confirm the results in steps (2) through (4) on the wattmeter.

(6) Repeak the points in steps (2) through (5) on each position of the BAND switch, then recheck the results to ensure maximum performance over the entire range 430–440 MHz.

(7) Set the meter switch to PO. Set the transceiver DRIVE or CARRIER control for an output of 12 watts. Adjust VR_{1203} for an indication of .8 on the PO meter.

(8) Beginning at zero drive, increase the level of the DRIVE or CARRIER control on the transceiver until the transverter power output does not increase further.

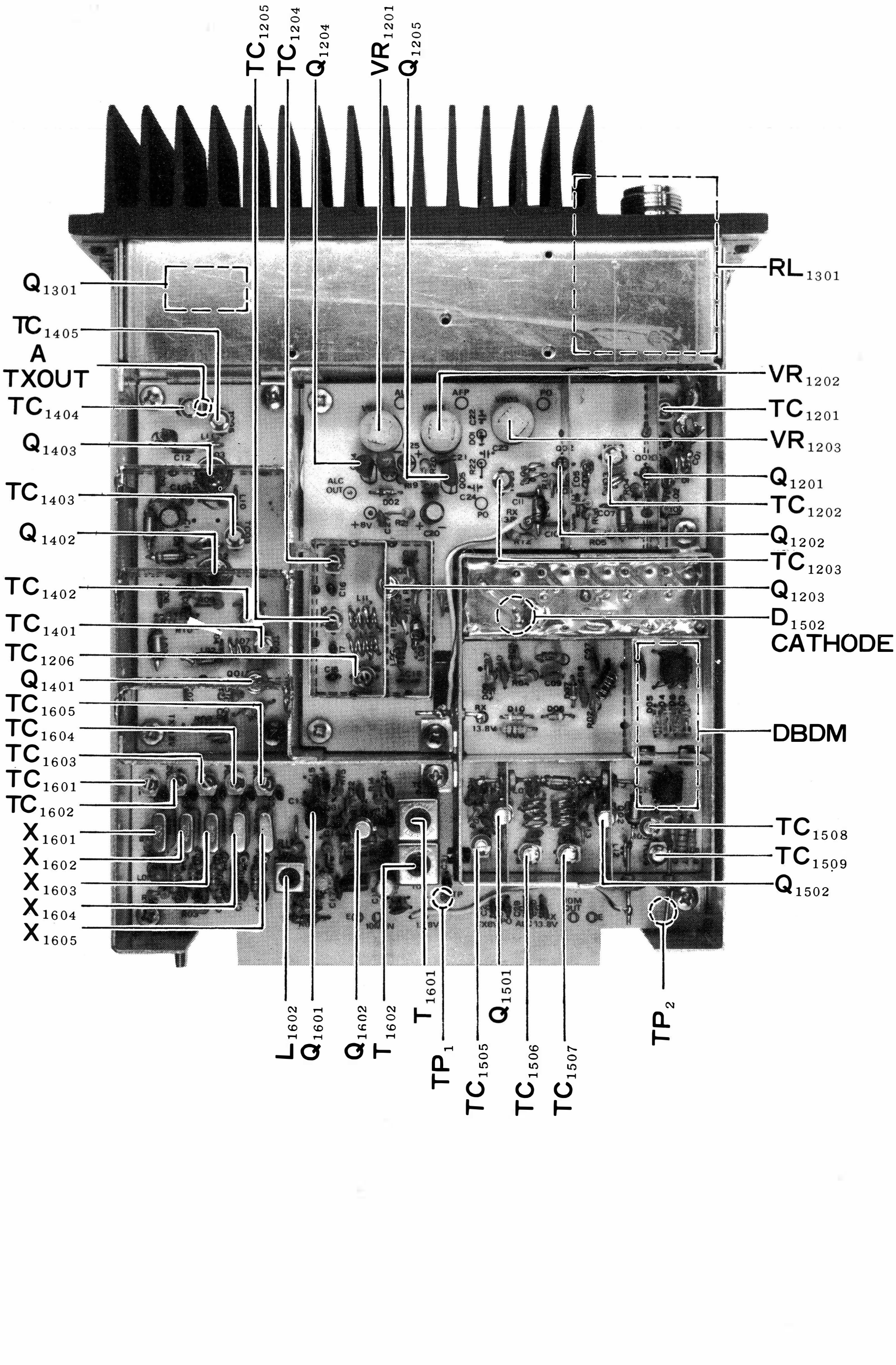
(9) Advance VR_{1201} slowly clockwise until equal power output is achieved across the 430–440 MHz range.

(10) Rotate VR_{1202} fully clockwise.

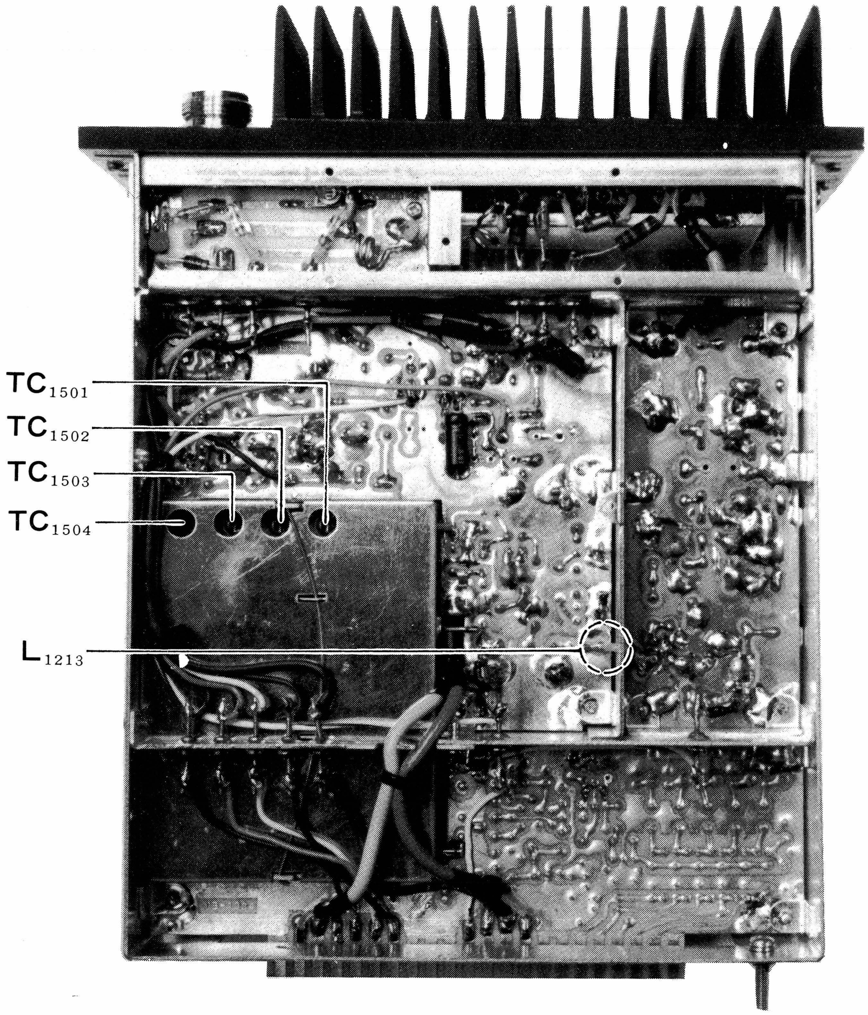
(11) While transmitting, rotate VR_{1301} to secure maximum power output on the wattmeter.

(12) Now rotate VR_{1202} fully clockwise. While transmitting, slowly rotate VR_{1202} counter-clockwise,until the power output just begins to fall off. Do not go past the threshold point.

(13) Remove the dummy load from the 430 MHz ANT jack. While transmitting, check to be sure that the PO meter indicates .2 with no load applied. If not, check the AFP unit for malfunctioning parts.



TC_{1205}
TC_{1204}
Q_{1204}
VR_{1201}
Q_{1205}
Q_{1301}
TC_{1405}
A
TXOUT
TC_{1404}
Q_{1403}
TC_{1403}
Q_{1402}
TC_{1402}
TC_{1401}
TC_{1206}
Q_{1401}
TC_{1605}
TC_{1604}
TC_{1603}
TC_{1601}
TC_{1602}
X_{1601}
X_{1602}
X_{1603}
X_{1604}
X_{1605}
RL_{1301}
VR_{1202}
TC_{1201}
VR_{1203}
Q_{1201}
TC_{1202}
Q_{1202}
TC_{1203}
Q_{1203}
D_{1502}
CATHODE
DBDM
TC_{1508}
TC_{1509}
Q_{1502}
L_{1602}
Q_{1601}
Q_{1602}
T_{1602}
T_{1601}
TP_{1}
TC_{1505}
Q_{1501}
TC_{1506}
TC_{1507}
TP_{2}


TC1501
TC1502
TC1503
TC1504
L1213

FTV-901R PARTS LIST

MAIN CHASSIS

Symbol No.	Parts No.	Description			
		DIODE			
D1–6, 10, 13	21090011	Silicon Diode			10D1
D7–9, 11, 12	21015550	" "			1S1555
		RESISTOR			
R5	41143471	Carbon Film	1/4	TJ	470 Ω
R1	42144102	" Composition	"	GK	1 kΩ
R4	40143682	" Film	"	VJ	6.8 kΩ
R7	41143103	" "	"	TJ	10 kΩ
R3	40143123	" "	"	VJ	12 kΩ
R2	41143683	" "	"	TJ	68 kΩ
R6	41143105	" "	"	"	1 MΩ
		POTENTIOMETER			
VR1	49800120	VM10A50KΩB			50 kΩB
VR2	49800121	VM10A100KΩB			100 kΩB
		CAPACITOR			
C1, 2	30820103	Ceramic Disc	50 WV		0.01 μF
C4	36526474	Tantalum	35 WV		0.47 μF
C3	34220106	Electrolytic	16 WV		TW 10 μF
		METER			
M1	74000380	#250035			200 μA
		RELAY			
RL1	70000002	MX-2P			12 V
		RELAY SOCKET			
RLS1	69000003	PX-08			
		SWITCH			
S1	61000610	S21-6612			
S2	66400003	WD-2301			
		RECEPTACLE			
J1, 3	68000001	MBR-06B			
J2, 4	68020001	CN-7017J			
J5	68070027	D7-701B00			

Symbol No.	Parts No.	Description	
		MULTI JACK	
MJ1–3	68220003	121S-22B-105A	
		PLUG	
P1	68120006	5065-112 with wire	#240117

50 MHz UNIT

Symbol No.	Parts No.	Description	
		★★★★★ MAIN CHASSIS ★★★★★	
C101–106, 108–114	32821102	Ceramic Feed Thru	ECK-Y1H102WE
		★★★★★ 50 MHz CONVERTER MAIN BOARD ★★★★★	
PB-1922	60419220	Printed Circuit Board	
	019220AZ	PCB with Components	
		IC, FET, TRANSISTOR	
Q201	25000101	IC	MC1496G
Q209	25000128	"	78L08
Q202,205,206	23800510	FET	3SK51
Q203	22320530	Transistor	2SC2053
Q204	22307300	"	2SC730
Q207, 208	22307842	"	2SC784R
Q210, 211	22318154	"	2SC1815Y
		DIODE	
D201, 202, 212, 213	21090113	Silicon	1SS53
D208, 214–219	21015550	"	1S1555
D203–207, 209–211	21022090	Varactor	1S2209
		CRYSTAL	
X201	71800140	HC-18/U	22.0 MHz
X202	71800141	"	24.0 MHz
X203	71800142	"	23.0 MHz
X205	71800139	"	21.0 MHz
		CRYSTAL SOCKET	
XS201	69010013	S-14-4P	

		RESISTOR
R226	40143100	Carbon Film 1/4S VJ 10 Ω
R207, 230	40143560	" " " " 56 Ω
R204,209,211, 214,223,255, 258	40143101	" " " " 100 Ω
R221,237,243	40143221	" " " " 220 Ω
R224	40143271	" " " " 270 Ω
R202, 254	40143471	" " " " 470 Ω
R205	41143821	" " 1/4 TJ 820 Ω
R201,203,208, 238,244,251, 257,259	40143102	" " 1/4S VJ 1 kΩ
R229	40143122	" " " " 1.2 kΩ
R206, 245–250	40143152	" " " " 1.5 kΩ
R225	40143332	" " " " 3.3 kΩ
R210,252,253	40143103	" " " " 10 kΩ
R235	40143223	" " " " 22 kΩ
R219	40143393	" " " " 39 kΩ
R241, 242	40143473	" " " " 47 kΩ
R256	40143823	" " " " 82 kΩ
R212,213,215 –217, 220,	40143104	" " " " 100 kΩ
234,239,240		
R222, 233	41143104	" " 1/4 TJ 100 kΩ
R218	40143224	" " 1/4S VJ 220 kΩ
R236	40143225	" " " " 2.2 MΩ
		POTENTIOMETER
VR201–203	49919473	SR19RS 47 kΩB
		CAPACITOR
C213, 245	31829095	Ceramic Disc 50WV SL 0.5 pF
C222, 242	31820010	" " " CH 1 pF
C211,215,218, 236,243,246,	31820050	" " " " 5 pF
278		
C203, 210	31829100	" " " SL 10 pF
C237,247,251	31820100	" " " CH 10 pF
C249	31820150	" " " " 15 pF
C228	31829180	" " " SL 18 pF
C216	31829200	" " " " 20 pF
C219	31829220	" " " " 22 pF
C260–265, 269	31820220	" " " CH 22 pF
C223	31820270	" " " " 27 pF
C235	31829330	" " " SL 33 pF
C204,233,234	31829470	" " " " 47 pF
C212,214,217, 250	31820470	" " " CH 47 pF
C238,241,244	31827470	" " " UJ 47 pF
C201, 202	31829910	" " " SL 91 pF
C225	31829101	" " " " 100 pF
C207,208,267, 268	31820101	" " " CH 100 pF

C273, 275	31829121	Ceramic Disc 50WV SL 120 pF
C274	31829241	" " " " 240 pF
C232,252,266	30820102	" " " 0.001 μF
C205,206,209, 220,221,224, 226,227,230, 231,239,240, 248, 253–259, 270–272, 283–288, 292	30820103	" " " 0.01 μF
C291	36825473	Mylar 50WV 0.047 μF
C229,276,277, 290	34220106	Electrolytic 16WV 10 μF
		TRIMMER CAPACITOR
TC201–207	39000011	ECV1ZW 20 x 53N 20 pF
		TRANSFORMER
T201–208	55003309	#220408
T209	54141800	R12-4180, #220166
		INDUCTOR
L211, 212	53020038	Micro Inductor FL-4H 0.68 μH
L214	53020005	" " " 3.3 μH
L207, 209	53020006	" " " 6.8 μH
L213	53020033	" " " 10 μH
L210	53020001	" " FL-5H 1 mH
L208	55003174	#220209
L202,204,206	55003262	#220324
L203	55003310	#220416A
L201	55003371	#220535
L205	55003372	IFT-51S10-H3
		FERRITE BEADS
	56000024	Ri 3 x 3-1
	91100008	Wrapping Terminal C
		HEAT SINK
	95000004	T0-5, L = 15 mm
		★★★★★ 50 MHz BOOSTER BOARD ★★★★★
PB-1923	60419230	Printed Circuit Board
	019230AZ	PCB with Components

Symbol No.	Parts No.	Description	
		TRANSISTOR	
Q301	22321660	Transistor	2SC2166
Q302	22319454	″	2SC1945D
		DIODE	
D301,302,308	21090011	Silicon	10D1
D307	21001880	Germanium	1S188FM
D303–306	21015550	Silicon	1S1555
		RESISTOR	
R303	42124560	Carbon Composition ½ GK	56 Ω
R306	42124101	″ ″ ″ ″	100 Ω
R305	42124151	″ ″ ″ ″	150 Ω
R302	42124221	″ ″ ″ ″	220 Ω
R301, 304 (L302, 305)	42124471	″ ″ ″ ″	470 Ω
R308	41143102	Carbon Film 1/4S TJ	1 kΩ
R307	40143103	″ ″ ″ VJ	10 kΩ
		POTENTIOMETER	
VR301	49906301	EVL-SOAA00B32	300 ΩB
VR302	49906103	EVL-SOAA00B14	10 kΩB
		CAPACITOR	
C334	31829095	Ceramic Disc 50WV SL	0.5 pF
C316, 335	31829010	″ ″ ″ ″	1 pF
C310, 315	31829050	″ ″ ″ ″	5 pF
C302	31829200	″ ″ ″ ″	20 pF
C301, 317	31829330	″ ″ ″ ″	33 pF
C307	31829390	″ ″ ″ ″	39 pF
C320, 329	31829470	″ ″ ″ ″	47 pF
C323	31829620	″ ″ ″ ″	62 pF
C314, 324	31829820	″ ″ ″ ″	82 pF
C321, 328	31829101	″ ″ ″ ″	100 pF
C319	31829121	″ ″ ″ ″	120 pF
C304,306,309, 311,313,318, 326,327,331, 333	30820103	″ ″ ″	0.01 μF
C303,305,308, 312,330,332	36226226	Electrolytic 16WV TW	22 μF
		INDUCTOR	
L314	53010001	Micro Inductor	10 μH
L304, 313	55003160		#220196
L302, 305	55003262		#220324
L301	55003373		#220527
L303, 306	55003374		#220528
L307	55003375		#220529
L308–310, 312	55003376		#220530

Symbol No.	Parts No.	Description	
L311	55003377		#220584
		TRIMMER CAPACITOR	
TC301	39000011	ECV-1ZW 20 x 40N	20 pF
TC302, 303	39000009	ECV-1ZW 50 x 40N	50 pF
TC304, 305	38820080	2222-808-61809	80 pF
		RELAY	
RL301	70000031	FBR-221D012	
		CONNECTOR	
J301	68000003	SO-239	
	91100008	Wrapping Terminal C	
	80050741	Booster Heat Sink	

144 MHz UNIT

Symbol No.	Parts No.	Description	
		★★★★★ MAIN CHASSIS ★★★★★	
C501–506, 508, 509, 511–513, 515	32821102	Ceramic Feed Thru ECK-Y1H102WE	
C517	36825223	Mylar 50WV	0.022 μF
		RESISTOR	
R501	41143473	Carbon Film 1/4S TJ	47 kΩ
		★★★★★ 144 MHz CONVERTER MAIN BOARD ★★★★★	
PB-1925	60419250	Printed Circuit Board	
	019250AZ	PCB with Components	
		IC, FET, TRANSISTOR	
Q601	25000101	IC	MC-1496G
Q610	25000128	″	78L08
Q602,605,606	23800510	FET	3SK51
Q604	22307300	Transistor	2SC730
Q607–609	22307842	″	2SC784R
Q611, 612	22318154	″	2SC1815Y
Q603	22320530	″	2SC2053

		DIODE
D601,606,607, 609–614,616	21090113	Silicon 1SS53
D605	21015550	″ 1S1555
D602–604,608	21022090	Varactor 1S2209
		CRYSTAL
X601	71800144	HC-18/U 38.6666 MHz
X602	71800145	″ 39.3333 MHz
X603	71500193	HC-25/U 38.8666 MHz
X604	71500194	″ 39.5333 MHz
X605	71500195	″ 38.4666 MHz
X606	71500196	″ 39.1333 MHz
		CRYSTAL SOCKET
XS601	69010013	S-14-4P
		RESISTOR
R624	40143100	Carbon Film 1/4S VJ 10 Ω
R638	40143220	″ ″ ″ ″ 22 Ω
R609,620,621, 625,633	40143560	″ ″ ″ ″ 56 Ω
R604,608,611, 614,651,655, 659	40143101	″ ″ ″ ″ 100 Ω
R629	40143221	″ ″ ″ ″ 220 Ω
R647 (L613)	42124471	″ Composition 1/2 GK 470 Ω
R665	41143471	″ Film 1/4S TJ 470 Ω
R650,654,658	40143471	″ ″ ″ VJ 470 Ω
R602, 622	40143561	″ ″ ″ ″ 560 Ω
R640–645	40143681	″ ″ ″ ″ 680 Ω
R605	41143821	″ ″ ″ TJ 820 Ω
R601,603,607, 634,635,660	40143102	″ ″ ″ VJ 1 kΩ
R626,637,639	40143122	″ ″ ″ ″ 1.2 kΩ
R606	40143152	″ ″ ″ ″ 1.5 kΩ
R652, 656	40143472	″ ″ ″ ″ 4.7 kΩ
R623	41143682	″ ″ ″ TJ 6.8 kΩ
R610, 666	40143104	″ ″ ″ VJ 10 kΩ
R618,619,628, 653,657	40143223	″ ″ ″ ″ 22 kΩ
R617,631,632	40143473	″ ″ ″ ″ 47 kΩ
R612,613,615, 616,630,636	40143104	″ ″ ″ ″ 100 kΩ
R627	40143225	″ ″ ″ ″ 2.2 MΩ
R646	40143331	″ ″ ″ ″ 330 Ω
		POTENTIOMETER
VR601	49905472	SR19RS 4.7 kΩB
VR602	49905473	SR19RS 47 kΩB

		CAPACITOR
C614	31829059	Ceramic Disc 50WV SL 0.5 pF
C609, 616	31820020	″ ″ ″ CH 2 pF
C612	31820040	″ ″ ″ ″ 4 pF
C613, 615	31827040	″ ″ ″ UJ 4 pF
C611, 617	31829050	″ ″ ″ SL 5 pF
C641,650–655	31820050	″ ″ ″ CH 5 pF
C642	31827050	″ ″ ″ UJ 5 pF
C608, 610	31827080	″ ″ ″ ″ 8 pF
C604, 637	31829100	″ ″ ″ SL 10 pF
C631,632,664, 668	31820100	″ ″ ″ CH 10 pF
C639	31829150	″ ″ ″ SL 15 pF
C658	31820180	″ ″ ″ CH 18 pF
C665	31829220	″ ″ ″ SL 22 pF
C626	31829270	″ ″ ″ ″ 27 pF
C660	31820270	″ ″ ″ CH 27 pF
C623	31829330	″ ″ ″ SL 33 pF
C627	31829390	″ ″ ″ ″ 39 pF
C640	31829470	″ ″ ″ ″ 47 pF
C656	31820680	″ ″ ″ CH 68 pF
C601, 602	31829910	″ ″ ″ SL 91 pF
C685	31829101	″ ″ ″ ″ 100 pF
C659	31820101	″ ″ ″ CH 100 pF
C607,618,619, 621,622,624, 625,628,630, 633–635,643, 657,662,663, 667,669,672, 673,678,679	30820102	″ ″ ″ 0.001 µF
C605,606,636, 638,644–649, 661, 680, 682–684	30820103	″ ″ ″ 0.01 µF
C620,629,670, 671,681	34220106	Electrolytic 16WV TW 10 µF
		TRIMMER CAPACITOR
TC601	39000010	ECV-1ZW 10 x 53N 10 pF
TC602, 603, 606–612	39000011	ECV-1ZW 20 x 53N 20 pF
TC604, 605	39000005	ECV-1ZW 50 x 32N 50 pF
		INDUCTOR
L605	53020038	Micro Inductor FL-4H 0.68 µH
L610,612,614	53020004	″ ″ ″ 2.2 µH
L611	53020006	″ ″ ″ 6.8 µH
L606, 608	55003090	″ ″ ″ #220193
L602	55003092	″ ″ ″ #220195
L603,604,609	55003093	″ ″ ″ #220196
L613	55003120	″ ″ ″ #220206
L607	55003294	″ ″ ″ #220380
L601	5503371	″ ″ ″ #220535

		TRANSFORMER
T604	54140910	R12-4091 #220105
T602, 603, 606–608	54141020	R12-4102 #220111
T605	54141800	R12-4180 #220166
T601	55003378	#220536
		HEAT SINK
	95000004	TO-5, L = 15 mm
		FERRITE BEADS
	56000024	Ri 3 x 3-1
	91100008	Wrapping Terminal C
★★★★★ 144 MHz BOOSTER BOARD ★★★★★		
PB-1926	60419260	Printed Circuit Board
	019260AZ	PCB with Components
PB-1927	60419270	Printed Circuit Board
	019270AZ	PCB with Components
		POWER MODULE
Q701	78000002	VP-20BL
		DIODE
D704	21090011	Silicon 10D1
D701	21001880	Germanium 1S188FM
D702, 703	21015550	Silicon 1S1555
		RESISTOR
R705	40143472	Carbon Film 1/4S VJ 4.7 kΩ
R706	40143473	" " " " 47 kΩ
R701 (L702), 704 (L704)	42124471	Carbon Composition ½ GK 470 Ω
R702 (L702), 703 (L703)	42144471	" " ¼ " 470 Ω
		POTENTIOMETER
VR701	49906301	EVL-SOAA00B32 300 ΩB
VR702	49906103	EVL-SOAA00B14 10 kΩB
		CAPACITOR
	31829059	Ceramic Disc 50WV SL 0.5 pF

C710, 712	31829010	Ceramic Disc 50WV SL 1 pF
C713	31829020	" " " " 2 pF
C708,716,717	31829150	" " " " 15 pF
C706	31829200	" " " " 20 pF
C707	31829330	" " " " 33 pF
C705,711,714, 715	30820102	" " " 0.001 μF
C701–704	34220106	Electrolytic 16WV TW 10 μF
		INDUCTOR
L707	55003380	#220069
L701, 704	55003262	#220324
L706, 708	55003306	#220430
L702, 703		#220469
L705		L0020654
		RELAY
RL701	70000035	FBR-221D012
		RECEPTACLE
J701	68000003	SO-239
	91100008	Wrapping Terminal C
★★★★★ RESONATOR BOARD ★★★★★		
PB-1800	60418000	Printed Circuit Board
	018000AZ	PCB with Components
		CAPACITOR
C1005–1008	31820050	Ceramic Disc 50WV CH 5 pF
C1001–1004	31820150	" " " " 15 pF
		TRIMMER CAPACITOR
T1001–1004	39000010	ECV-1ZW 10x53N 10 pF
		INDUCTOR
L1001	55003381	#220252
	80044942	Resonator Case
	91100008	Wrapping Terminal C

430 MHz UNIT

Symbol No.	Parts No.	Description
		★★★★★ **MAIN CHASSIS** ★★★★★
C1101–1108, 1110–1115	32821102	Ceramic Feed Thru ECK-Y1H102WE
		★★★★★ **430 MHz RF BOARD** ★★★★★
PB-1929	60419290	Printed Circuit Board
	019290AZ	PCB with Components
		TRANSISTOR
Q1203	22314240	Transistor 2SC1424
Q1204, 1205	22318154	〃 2SC1815Y
Q1201, 1202	22323690	〃 2SC2369
		DIODE
D1203	21090113	Silicon 1SS53
D1201	21015550	〃 1S1555
		RESISTOR
R1215	40143820	Carbon Film 1/4S VJ 82 Ω
R1205, 1210	40143101	〃 〃 〃 〃 100 Ω
R1204	40143221	〃 〃 〃 〃 220 Ω
R1203(L1202), 1206(L1204), 1209(L1205), 1211(L1207), 1216–1218 (L1208–1210)	42144471	Carbon Composition 1/4 GK 470 Ω
R1212, 1213	40143102	Carbon Film 1/4S VJ 1 kΩ
R1201, 1207, 1223	40143152	〃 〃 〃 〃 1.5 kΩ
R1202, 1208, 1214, 1225	40143103	〃 〃 〃 〃 10 kΩ
		POTENTIOMETER
VR1201–1203	49905473	SR19RS 47 kΩB
		CAPACITOR
C1202, 1203	31829030	Ceramic Disc 50WV SL 3 pF
C1216, 1218	31820050	〃 〃 〃 CH 5 pF
C1212	31820200	〃 〃 〃 〃 20 pF
C1201, 1221, 1222, 1229	30820102	〃 〃 〃 〃 0.001 μF
C1204–1211, 1213, 1215, 1228	30825102	〃 HDC60E102M 0.001 μF
C1214, 1226	30325103	〃 Chip 25 V 0.01 μF
C1231	36825473	Mylar 50WV 0.047 μF
C1230	34220106	Electrolytic 16WV TW 10 μF
		TRIMMER CAPACITOR
TC1201, 1204 –1206	39000016	ECV-1ZW 04 x 53N 4 pF
TC1202, 1203	39000010	ECV-1ZW 10 x 53N 10 pF
		INDUCTOR
L1214	53020033	Micro Inductor FL-4H 10 μH
L1202, 1204, 1205, 1207–1210	55003382	#220469
L1211, 1212	55003383	#220471
L1203, 1206	55003384	#220472
L1213	55003385	#220474
L1201	55003386	#220523
		★★★★★ **430 MHz BOOSTER BOARD** ★★★★★
PB-1935	60419350	Printed Circuit Board
	019350AZ	PCB with Components
		POWER MODULE
Q1301	78000003	VP-07BL
		DIODE
D1301	21090011	Silicon 10D1
D1302–1304	21001880	Germanium 1S188FM
		RESISTOR
	42124220	Carbon Composition 1/2 GK 22 Ω
	42124270	〃 〃 〃 〃 27 Ω
R1301(L1308), 1302(L1309), 1304(L1301), 1305(L1302)	42144471	〃 〃 1/4 〃 470 Ω
		POTENTIOMETER
VR1301	49908506	EVN-A00B32 300 ΩB
		CAPACITOR
C1304, 1309	31829020	Ceramic Disc 50WV SL 2 pF
C1308	30820102	〃 〃 〃 〃 0.001 μF
C1301, 1302	34220106	Electrolytic 16WV TW 10 μF

		TRIMMER CAPACITOR
TC1301		ECV1ZW 06 x 32 6 pF
		INDUCTOR
L1301, 1302, 1308, 1309	55003382	#220469
L1303, 1304	55003392	#220525
		RELAY
RL1301	70000035	CX-140N (with J1301)
		FERRITE BEADS
	56000024	Ri 3 x 3-1
******* 430 MHz EXCITER BOARD *******		
PB-1930	60419300	Printed Circuit Board
	019300AZ	PCB with Components
		TRANSISTOR
Q1401	22314240	Transistor 2SC1424
Q1402, 1403	22314260	〃 2SC1426
		DIODE
D1401	21015550	Silicon 1S1555
		RESISTOR
R1408	40143220	Carbon Film 1/4S VJ 22 Ω
R1405	40143820	〃 〃 〃 〃 82 Ω
R1415	40143221	〃 〃 〃 〃 220 Ω
R1401(L1401), 1406(L1402), 1407(L1403), 1412(L1404), 1413(L1405), 1416(L1406)	42144471	Carbon Composition 1/4 GK 470 Ω
R1409	40143471	Carbon Film 1/4S VJ 470 Ω
R1403	41143471	〃 〃 〃 TJ 470 Ω
R1404, 1410, 1414	40143102	〃 〃 〃 VJ 1 kΩ
R1402, 1411	41143562	〃 〃 〃 TJ 5.6 kΩ

		CAPACITOR
C1401–1410, 1412	30825102	Ceramic HDC60E102M 0.001 μF
C1411	34220106	Electrolytic 16WV TW 10 μF
		TRIMMER CAPACITOR
TC1401–1403, 1405, 1406	39000010	ECV-1ZW 10 x 53N 10 pF
		INDUCTOR
L1401–1406	55003382	#220469
L1407	55003384	#220472
L1409, 1411	55003388	#220473
L1408, 1410	55003387	#220522
******* 430 MHz CONVERTER BOARD *******		
PB-1931	60419310	Printed Circuit Board
	019310AZ	PCB with Components
PB-1932	60419320	Printed Circuit Board
	019320AZ	PCB with Components
PB-1933	60419330	Printed Circuit Board
	019330AZ	PCB with Components
		TRANSISTOR
Q1501, 1502	22314240	Transistor 2SC1424
		DIODE
D1503–1506	21090152	Schottky Barrier 1SS43
D1507–1510	21090113	Silicon 1SS53
D1501, 1502	21090142	〃 MC-301
D1511	21001880	Germanium 1S188FM
		RESISTOR
R1504	40143180	Carbon Film 1/4S VJ 18 Ω
R1517	41143108	〃 〃 〃 TJ 18 Ω
R1515	40143220	〃 〃 〃 VJ 22 Ω
R1510	40143101	〃 〃 〃 〃 100 Ω
R1518, 1519	41143331	〃 〃 〃 TJ 330 Ω
R1502, 1505	40143331	〃 〃 〃 VJ 330 Ω
R1511(L1507), 1512(L1510), 1516(L1511)	42144471	Carbon Composition 1/4 GK 470 Ω
R1513	40143561	Carbon Film 1/4S VJ 560 Ω
R1501, 1506	41143102	〃 〃 〃 TJ 1 kΩ
R1503, 1507	40143102	〃 〃 〃 VJ 1 kΩ
R1508	40143222	〃 〃 〃 〃 2.2 kΩ
R1514	41143103	〃 〃 〃 TJ 10 kΩ
R1509	41143223	〃 〃 〃 〃 22 kΩ

		CAPACITOR
C1524, 1525	31820059	Ceramic Disc 50WV CH 0.5 pF
C1526	31820020	〃 〃 〃 〃 2 pF
C1513, 1514	31820030	〃 〃 〃 〃 3 pF
C1502–1505	31820080	〃 〃 〃 〃 8 pF
C1515	31829100	〃 〃 〃 SL 10 pF
C1523	31829270	〃 〃 〃 〃 27 pF
C1506, 1507	31820620	〃 〃 〃 CH 62 pF
C1511, 1512, 1516	30825102	〃 HDC60E102M 0.001 μF
C1517–1522	32821102	〃 Feed Thru 50WV 0.001 μF
C1501	30820102	〃 Disc 50WV 0.001 μF
C1508–1510	30820103	〃 〃 〃 0.01 μF
		TRIMMER CAPACITOR
TC1501–1504, 1509	39000017	ECV-1ZW 06 x 53N 6 pF
TC1505–1508	39000010	ECV-1ZW 10 x 53N 10 pF
		INDUCTOR
L1505, 1513	55003393	AT0706HHQ5B252A
L1507, 1510, 1511	55003382	#220469
L1506	55003389	#220470
L1501–1504, 1508, 1509	55003383	#220471
L1512	55003390	#220476
		HERMETIC SEAL
	91001102	A102
		★★★★★ LOCAL BOARD ★★★★★
PB-1934	60419340	Printed Circuit Board
	019340AZ	PCB with Components
		IC, TRANSISTOR
Q1603	25000128	IC 78L08
Q1601	22307842	Transistor 2SC784R
Q1602	22314240	〃 2SC1424
		DIODE
D1601–1605	21090113	Silicon 1SS53

		CRYSTAL
X1601	71800146	HC-18/U 67.000 MHz
X1602	71800147	〃 67.333 MHz
X1603	71800148	〃 67.666 MHz
X1604	71800149	HC-25/U 68.000 MHz
X1605	71800150	〃 68.333 MHz
		RESISTOR
R1616	40143101	Carbon Film 1/4S VJ 100 Ω
R1618	41143101	〃 〃 〃 TJ 100 Ω
R1614	40143221	〃 〃 〃 VJ 220 Ω
R1601	40143331	〃 〃 〃 〃 330 Ω
R1612, 1615	40143471	〃 〃 〃 〃 470 Ω
R1607–1611	41143681	〃 〃 〃 TJ 680 Ω
R1617	40143272	〃 〃 〃 VJ 2.7 kΩ
R1602, 1603, 1605, 1606	40143103	〃 〃 〃 〃 10 kΩ
R1604	41143103	〃 〃 〃 TJ 10 kΩ
R1613	40143273	〃 〃 〃 VJ 27 kΩ
		CAPACITOR
C1625	31829059	Ceramic Disc 50WV SL 0.5 pF
C1631	31820010	〃 〃 〃 CH 1 pF
C1623, 1626	31820040	〃 〃 〃 〃 4 pF
C1602–1606	31820050	〃 〃 〃 〃 5 pF
C1613	31820100	〃 〃 〃 〃 10 pF
C1616	31820270	〃 〃 〃 〃 27 pF
C1601, 1614	31820470	〃 〃 〃 〃 47 pF
C1607–1611, 1621, 1622, 1624, 1627–1630	30820102	〃 〃 〃 0.001 μF
C1615, 1617	30820103	〃 〃 〃 0.01 μF
C1620	30820473	〃 〃 〃 0.047 μF
C1618, 1619	34220106	Electrolytic 16WV TW 10 μF
		TRIMMER CAPACITOR
TC1601–1605	39000011	ECV-1ZW 20 x 53N 20 pF
		INDUCTOR
L1601	53020001	Micro Inductor FL-4H 1 μH
L1602	53030011	TM-80160
		TRANSFORMER
T1601, 1602	55003394	MB-80050
	91100008	Wrapping Terminal C

POWER SUPPLY UNIT

Symbol No.	Parts No.	Description
	★★★★★ MAIN CHASSIS ★★★★★	
		TRANSISTOR
Q1708	22490003	MJE3055
		DIODE
D1707	21090118	Silicon Bridge S4VB
		CAPACITOR
C1708	34520109	Electrolytic 35WV TW 10000 μF
C1709, 1710	30240472	Ceramic Disc 1.4 KV 0.0047 μF
		POWER TRANSFORMER
PT1701	52000046	#230025
		FUSE
F1702	73000002	(100–117 V) 2A
	73000001	(200–234 V) 1A
		FUSE HOLDER
FH1702	69030004	F3292
		POWER SUPPLY BOARD
PB-1945	60419450	Printed Circuit Board
	019450AZ	PCB with Components
		IC, TRANSISTOR
Q1702	25000074	IC TA7089M
Q1706	25000116	" μPC14308
Q1703–1705	22318154	Transistor 2SC1815Y
Q1701	22402353	" 2SD235-O
		DIODE
D1701–1705	21090011	Silicon 10D1
D1706	21090036	Zener WZ-110
		RESISTOR
R1707	40143121	Carbon Film 1/4S VJ 120 Ω
	40143271	" " " " 270 Ω
R1703	42124102	Carbon Composition 1/2 GK 1 kΩ
R1702	40143332	Carbon Film 1/4S VJ 3.3 kΩ
R1701	40143123	" " " " 12 kΩ
R1704–1706	40143223	" " " " 22 kΩ

		POTENTIOMETER
VR1701	49906202	EVL-S0AA00B23 2 kΩB
		CAPACITOR
C1707	30820102	Ceramic Disc 50WV 0.001 μF
C1703, 1705	30820103	" " " 0.01 μF
C1704	30820473	" " " 0.047 μF
C1706	34329105	Electrolytic 25WV TW 1 μF
C1702	34329108	" " " 1000 μF
C1701	34529002	" 35WV R 1000 μF
		RELAY
RL1701	70000031	FBR211D012
		PLUG
P1701	67110001	5079-11A
		FUSE
F1701	73000004	5A
		FUSE HOLDER
FH1701	69030007	F3265
	91100008	Wrapping Terminal C

ALC AMP UNIT

Symbol No.	Parts No	Description
PB-1946	60419460	Printed Circuit Board
	019460AZ	PCB with Components
		FET
Q1801	23800594	3SK59Y
		DIODE
D1801, 1802	21015550	Silicon 1S1555
D1803	21090138	Varistor MV103
		RESISTOR
R1802	40143221	Carbon Film 1/4 VJ 220 Ω
R1808	40143102	" " " " 1 kΩ
R1806	40143152	" " " " 1.5 kΩ
R1803	40143103	" " " " 10 kΩ
R1801, 1809	40143223	" " " " 22 kΩ
R1807	40143273	" " " " 27 kΩ

R1804	40143274	Carbon Film 1/4 VJ 270 kΩ
		POTENTIOMETER
VR1801	49906103	EVL-S0AA00B14 10 kΩB
VR1802, 1803	49906503	EVL-S0AA00B54 50 kΩB
		CAPACITOR
C1801, 1809	31829100	Ceramic Disc 50WV SL 10 pF
C1812	31829910	〃 〃 〃 〃 91 pF
C1810	31829111	〃 〃 〃 〃 110 pF
C1811	31829181	〃 〃 〃 〃 180 pF
C1815–1818	32821102	Ceramic Feed Thru ECK-Y1H102WE
C1804	30830102	Ceramic Disc 50WV 0.001 μF
C1802, 1803, 1805, 1807, 1808, 1814	30820103	〃 〃 〃 0.01 μF
		INDUCTOR
L1801, 1804		Micro Inductor FL-5H 47 μH
L1802, 1803	55003371	#220535
		TRANSFORMER
T1801	52000047	R12-4434 #220180
		HERMETIC SEAL
	91001102	A-102
	91100008	Wrapping Terminal C

VR UNIT

Symbol No.	Parts No.	Description
PB-1947	60419470	Printed Circuit Board
	019470AZ	PCB with Components
		TRANSISTOR
Q1901, 1902	22318154	2SC1815Y
		DIODE
D1901–1915	21015550	Silicon 1S1555
D1916, 1917	21090011	〃 10D1
		RESISTOR
R1906	40143220	Carbon Film 1/4 VJ 22 Ω
R1901	40143102	〃 〃 〃 〃 1 kΩ
R1902, 1903	40143103	〃 〃 〃 〃 10 kΩ
R1904, 1905	40143223	〃 〃 〃 〃 22 kΩ
		POTENTIOMETER
VR1901–1912	49906503	EVL-S0AA00B54 50 kΩB
		CAPACITOR
C1915	31829010	Ceramic Disc 50WV SL 1 pF
C1901–1914, 1916, 1918, 1919	30820103	〃 〃 〃 0.01 μF
C1917	34220476	Electrolytic 16WV TW 47 μF
C1920	34320477	〃 25WV TW 470 μF
		RELAY
RL1901	70000031	FBR211D012
	91100008	Wrapping Terminal C

LED UNIT

Symbol No.	Parts No.	Description
PB-1948	60419480	Printed Circuit Board
	019480AZ	PCB with Components
		LED
Q2001–2009	20900140	GD4-203SRD
		RESISTOR
R2001–2009	41143681	Carbon Film 1/4 TJ 680 Ω

SW UNIT

Symbol No.	Parts No.	Description
PB-1928	6049280	Printed Circuit Board
	019280AZ	PCB with Components
		SWITCH
S2101	64000101	SLE-62301
S2102, 2104	64000103	SLE-62251
S2103	64000108	SLE-64251

ACCESSORIES

Symbol No.	Parts No.	Description
		Connection Cable A
		" " B
		" " C
	67020001	RCA Pin Plug STP-58
	73000004	Fuse 5A
	73000002	" 2A (100–117V)
	73000001	" 1A (200–234V)

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